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A CRITICAL REVIEW OF THE ROLE OF THE IMMATURE STAGES OF ANOPHELINE MOSQUITOES IN THE REGULATION OF ADULT NUMBERS, WITH PARTICULAR REFERENCE TO *ANOPHELES GAMBIAE*

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Introduction

The remarkable success of so many residual spraying campaigns in controlling malaria has resulted in the neglect of studies of the aquatic stages of anopheline mosquitoes, and a better understanding of the aquatic phase is still required. Understanding of the effects of residual spraying, and appreciation of the genetic problems involved in the development of resistance to insecticides, both

require an understanding of population dynamics, and this entails a full knowledge of the fate of eggs, larvae and pupae. Investigation of these stages can make real contributions to the solution of problems of malaria control, and must not be regarded as an academic quest for rational explanations of established practice.

This review is concerned mainly with the biology of the aquatic phases of the life cycle of *Anopheles gambiae,* and, to a lesser extent, of *A. funestus.* Its main purpose is to put forward a working hypothesis which describes ways in which the adult population is controlled by events in the aquatic environment. This hypothesis gives order to the study of these events and gives clear indications of lines of investigation that are immediately practicable, and likely to prove profitable.

The Nature of the Fluctuations of Populations of A. gambiae Adults, and the Connexion with Rainfall

There are two outstanding features of the numbers of *gambiae* present in any locality at various times. The first is that these show very marked seasonal fluctuations, usually with a maximum in the main rainy season. The second is that the density of mosquitoes found at the height of the peak, while varying from locality to locality, is broadly characteristic of this species, and is small compared with that of some temperate and sub-arctic mosquitoes.

These two statements are documented. They are also matters of general experience to people engaged in malaria control in tropical Africa ; references relating to the seasonal problem may be found in De Meillon (1947), and Gillies (1955) has described the population of *gambiae* and *funestus* in a single village in E. Africa, and contrasted this with a published estimate of the density of *quadrimaculatus* in one area.

The Connexion of Population Peak with Rainfall not always simple

The exceptions to the rule that the period of abundance of *gambiae* is the time of the main rains are of interest. First, there are certain cases where population events can still be explained in terms of available water, but where the relation of these events to rain is not direct. Wilson (1938) has recorded the anopheline house infestation at Arusha Chini, where, for sugar production, arid land is irrigated with water from the Kilimanjaro rivers. A slight peak was detectable at the time of the main rains, but high infestation was found all the year round. Reductions in the level of adult numbers could be attributed to work on the irrigation system. These results contrasted strongly with the findings at Usa where breeding was strictly seasonal, being dependent on overspill from seepage swamps. Where river pooling forms the main source of breeding, the peak populations of *gambiae* are found after the main rains, as reported by Wilson and Notley (1943), De Burca and Imdad Ali Shah (1943) and Melville *et al.* (1945).

Secondly, there are certain cases where the connexion with the extent of the water is not clear. Thus De Meillon (*loc. cit.*) quotes Mastbaum as having noted a big increase in the production of adults from permanent breeding places in the absence of rain. There is no indication of how close observation of these places was, and whether the possibility of interference with the breeding

places by human activity was ruled out. BOURGUIGNON (1944) records his impression that the start of the seasonal rise of malaria in Elisabethville, where *gambiae* is the chief vector, precedes the advent of the main rains; but gives no numerical data to support this impression. GILLIES (1954a) describes an incident in which an influx of newly emerged adults was detected in the mosquito population only 4 days after an isolated fall of rain. He suggests that this mass emergence was brought about by rain, which enlarged the breeding sites and so reduced the overcrowding of the larvae which had previously held the chances of survival at a low level. RIBBANDS (1944) also makes reference to the interaction of larvae as a suggested explanation of events in the adult population. He was concerned with populations of *Anopheles melas,* but suggested that the same might be true of *A. gambiae.* Both these studies were based on observations of adult mosquitoes only.

It may, then, be accepted that in the majority of cases there is a relation between the abundance of *A. gambiae* adults and of standing water. But it is an equally noticeable feature of the seasonal increase that a peak is reached fairly quickly and that the population enters a decline while plenty of standing water persists. This is agreed by many observers, and 3 examples are quoted by DE MEILLON (*loc. cit.*).

The Mechanism of this Connexion with Rainfall

DE MEILLON (*loc. cit.*), discussing the influence of rain on the numbers of *gambiae*, writes thus: "Because of its preference for small sunlit pools this species will obviously be more abundant and widespread in times of rain than otherwise". Certainly in an arid country the *gambiae* population will sink to a very low level during the dry season, dying out altogether in some places, while with the coming of the rainy season the few invaders or aestivators can increase rapidly. But if the country is not arid, that is to say some water persists through the season when rain is not falling, and *gambiae* is more abundant in times of rain because of its *preference* for small sunlit pools, then the implication is that the females cease to oviposit in the dry season. For this there is no evidence in the greater part of the range of *A. gambiae.* This point can be appreciated by considering what happens at the end of the rains, where this season is sharply demarcated, in non-arid country. The adult population has increased, *A. gambiae* is abundant: the rain stops, all puddles and small pools dry up, the great majority of eggs and larvae are lost, but the large adult population is left. There are no "preferred" breeding places left, and the females are forced to lay their eggs in other pools. The adult population fails to maintain itself and dwindles to a low level. There is no great fall in the sporozoite rate to suggest a big reduction in longevity of the females. There must, therefore, be some change in chances of survival of the immature stages. Indeed, in this review, as in recently published attempts to determine the daily survival rate of the adult mosquitoes, the pattern of adult survival is assumed to remain constant from month to month. This must be an oversimplification of the position, but will remain acceptable until methods of determining the age composition of the older half of the adult population are fully worked out, and applied. Despite advances in analysis of the age composition of the younger part of the population, no satisfactory method has been found for analysis of the older part.

Examination of the Existing Theories of the Natural Regulation of Animal Numbers

Before examining the conditions of life of the immature aquatic stages of *A. gambiae,* and attempting to speculate on the way in which the control of the population is effected, the literature of ecology must be considered in order to see to what extent the field of enquiry is defined by established theory. A distinction must be drawn between accepted and established theory.

Two opposed theories of the mechanism of the natural regulation of animal populations exist at present. The first of these theories is that such regulation must be effected by density-dependent factors, and it may be stated briefly as follows. It is an observed fact that the numbers of any species vary within recognizable limits. There must be some regulatory mechanism which confines the numbers of the species within these limits. This mechanism must be in the nature of some cause, or causes, of mortality that act more severely when the population increases, and less severely when the population decreases. Such causes of mortality are known as density-dependent factors and include starvation, predators and disease. Other factors, such as climate, do not bring about the death of a higher proportion of the population as this increases, and are called density-independent factors. Such factors may leave the population with a reproductive rate greater or less than unity, but act at random, and not in such a way as to return it to its average level. LACK (1954) accepts this view and discusses examples of density-dependent mechanisms in action. The examples which he discusses exhaustively are of bird populations.

On the other hand, ANDREWARTHA and BIRCH (1954) reject the theory of density-dependent factors, and adopt a purely empirical approach. They consider that the numbers of an animal are the result of the interaction between the species and its environment, and that the environment can be divided into 4 components which they call: weather, food, other animals and organisms causing disease, and a place in which to live. The relative importance of these components in determining the numbers will vary from species to species. In reaching these conclusions, Andrewartha and Birch were greatly influenced by their observations on the numbers of an insect, *Thrips imaginis,* in flower heads, which were continued over a period of 15 years at the same place.

SOLOMON (1957), reviewing the whole subject of regulation of numbers, puts the point at issue very clearly: " But to explain why the great irregular increases and decreases from year to year add up over a period to approximately zero, we seem to have only two alternatives, density dependence *at some point* [italics not in the original] in the population cycle, or pure chance."

A mathematical treatment of the problem has led SKELLAM (1955) to the conclusion that a population dependent on chance alone must become extinct. Neither his argument, nor Solomon's intuitive selection of the idea of density-dependent factors, define the frequency with which such factors will be seen in action. While the operation of density-dependent factors may provide the ultimate explanation of how the numbers of a species are kept within broad limits over the centuries, it may, or may not, be responsible for the fluctuations observed over 5 or 10 years. Much of the difficulty in this argument is removed by appreciation of the fact that the terms regulation or *control* of population may be loosely applied to a number of population events. Thus there are more mosquitoes immediately after the main rains than at other

times; there are more mosquitoes in an average hut in one village than in another; there are good years and bad years (with opposite meanings for the public health official and the investigating entomologist); and finally there is the remarkable fact that the numbers in the very best and the very worst years lie within certain limits. There is no reason why the same mechanism should be responsible for these four different phenomena. Nor should we expect that a single pattern of interaction between the animal and its environment should hold good for every species. The limits at which density-dependent factors operate may be very much more narrowly set, and the population may fluctuate more rapidly towards these limits, in one species than in another. Though Andrewartha and Birch's total rejection of the idea of density-dependent factors is not considered to be justified, the empirical approach is the correct one in this autecological study. The mechanisms producing the short-term fluctuations that form the subject of this study are not necessarily those that fix the ultimate limits of the population of *A. gambiae,* and, indeed, it may be that the chances of witnessing these mechanisms in action are very small in relation to the resources expended on the critical study of *gambiae.*

Nature of the Enquiry into the Role of the Immature Stages

The nature of the fluctuations in the adult populations of *A. gambiae* has been described. It has been stated that these fluctuations are largely due to changes in the chances of survival of the immature stages, namely egg, larva and pupa. The probability (A) of any individual fertilized egg becoming a free-flying adult is the product of the probabilities that it will survive through the egg stage to hatching (E), from hatching through the larval stage to pupation (L), and from pupation to emergence and successful flight from the breeding place (P). This relationship may be set out symbolically:

$$A = E \times L \times P$$

This use of symbols emphasizes the necessity of a proper knowledge of the fate of all three stages. Changes in one of these variables might appear to offer a ready explanation of changes observed in the adult population, when in fact they might be compensated by changes in another variable in the opposite sense.

The chief purpose of this paper is to put forward seven premises on which to build a coherent scheme explaining the seasonal changes in survival of these immature stages, and which will serve as bases for further analytical studies. These premises have been elaborated as a result of direct observation, and some experimental investigation of the immature stages of *A. gambiae.* In what follows these premises are first detailed; the population events of a particular locality are described in terms of these premises; their validity is discussed; and finally, methods for their further investigation are considered.

Premises on which a Scheme of Population Events can be Built

An explanation of the fluctuation of adult numbers of *A. gambiae* and *A. funestus* can be attempted by assuming the following 7 premises:—

1. Larvae are potentially able to complete development to emergence as normal adults in the majority of sites chosen by the ovipositing females which persist long enough. That is, physico-chemical and nutritional

conditions are adequate in the majority of collections of water persisting 8–9 days in the case of *gambiae* and about 15 days in the case of *funestus*.

2. The chances of survival to pupation in collections of water established for more than, say, 2 months, are very low indeed owing to the presence of predators.
3. In newly formed collections of water these predators are largely absent, although *Culex tigripes* is sporadically distributed.
4. Unless the water level is rising during the time of their development, the majority of eggs laid in temporary sites will be stranded on the soil. Though they may hatch if reflooded within a period of several days, they will be exposed to scavenging ants, and to the dangers of desiccation; their chances of survival are low.
5. *A. gambiae* will not oviposit in water with dense emergent vegetation.
6. *A. funestus* favours sites with emergent vegetation for oviposition.
7. Swamps persisting several months after the rainy season become stagnant, and conditions in them are such that survival of larvae of *A. funestus* is very low.

Anopheline Population Events in a Particular Village Explained in Terms of these Premises

The significance of these assumptions is best seen by discussion of a concrete example. The example chosen is a small village at the foot of the E. Usambara mountains of Tanganyika Territory, some 8 miles west of the village (Tengeni) described by GILLIES (1954b). Conditions are much as described by him, but

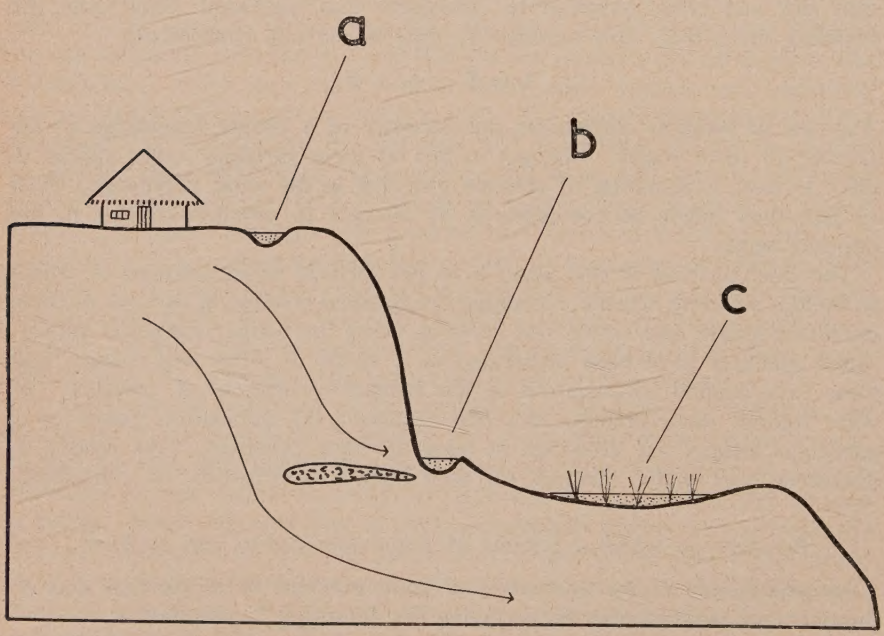

Fig. 1.—Diagram illustrating types of water accumulation discussed in the text. a. Pit resulting from building. b. Village well. c. Shallow temporary swamp or ricefield.

as this village is nearer the mountains than Tengeni, the ground is more deeply dissected. For the purposes of description of this particular case, a classification of accumulations of water in which larvae of *A. gambiae* may be found has been made. This classification is largely by location and can be understood by reference to fig. 1, in which an example of each type is represented diagrammatically. These types are:—

Type "A". Temporary accumulations of rain water and surface run-off. The pool shown in the diagram is a borrow pit formed by digging out soil for plastering a hut.

Type "B". Wells. The inhabitants of the village draw their water from shallow pools situated at the foot of steep slopes where rocks divert the flow of subsoil water to give seepage throughout the year. For many months there may be an overflow from the well, and this water meanders sluggishly over the surface of the valley bottom.

Type "C". Valley bottom. In this case the head of the re-entrant forms a gently sloping basin with a sill beyond which the gradient is again steep down to another nearly flat swampy area. The water ultimately finds its way into a rocky stream flowing in a narrow defile. This basin holds water for some months of the year, partly contributed by overflow from pools of type "B". The water-holding capacity is due to a superficial accumulation of clay; the subsoil is dry and sandy.

As said above, this classification has been made to help in the description of the problems of this particular locality. It is not intended to have any general significance. A convenient summary of the seasons can be made as follows:—

January to late March	hot dry season;
Late March to June	main rainy season;
July to October	cooler dry season;
November and December	short rainy season.

In January the whole countryside is dry, and where they persist, the shallow grassy swamps are quite stagnant. Oviposition of *A. gambiae* is restricted to pools of type "B", but owing to losses of larvae from predators, very few adults emerge. Some breeding of *A. funestus* continues in streams, and in the deep permanent swamps. Events continue thus until late February or early March when the local inhabitants clear the ground in some of the valley bottoms in preparation for rice cultivation, revealing shallow seepages. This clearing not only removes the vegetation which has been acting as a barrier to oviposition by *A. gambiae,* but also removes most of the rotted material which has been making the water unsuitable for development of larvae. This shallow sunlit water, overlying dark soil, reaches very high temperatures in the middle of the day. Although the water is of restricted extent, its level is fairly constant, so that losses of eggs are not very high, and a constant output of *gambiae* will be maintained. Such events are likely to produce some rise in the adult population inexplicable in terms of rainfall. Towards the end of March some rain falls. In places this rain falls on open ground (*e.g.,* paths), or ground that has been cleared (ricefields). In relatively few of these sites the water level rises for the 48 hours necessary to allow a high proportion of the eggs to hatch. There is a tendency to find small pockets of water containing large numbers of larvae with one stage predominating, reflecting a brief

period of rising water level favourable to hatching. Heavier and more frequent falls of rain follow in April and May, and the chances of eggs hatching rise, but the predatory fauna also establishes itself in the valley bottoms. For a short period, while conditions favourable for hatching more than counter-balance the as yet limited effect of the predators, these sites (type " C ") give a high output. At this time output of the type " A " sites is also at its highest. This one short period of the year is the main period of increase of *gambiae,* but depends on the pattern of rainfall. Rain that produces a continuous slow rise of water levels is clearly the most favourable.

When the main rainy season finishes at the end of June, the swamps and ricefields are full of water, and the vegetation, both rice and natural, has grown up. There is a catastrophic mortality of eggs and larvae of *A. gambiae* as small sites dry up. The vegetation now prevents *gambiae* from laying eggs in the majority of waters of type " C ", and the females are forced to lay in pools and wells where there are many predators, and the adult population falls off to a low level.

In the period July to October, the cooler dry season, the whole countryside is drying up. Ultimately many of the swamps become dry, or, if not actually dry, then quite stagnant. The adult population of *A. funestus,* which reaches its peak in August, declines towards the end of this period. A variable amount of rain in the short rains of November and December may temporarily regenerate swamps and allow some recrudescence of *funestus.* A number of sites, such as holes made by rooting pigs in the valleys and the larger temporary sites like " A " in fig. 1, allow some increase of *gambiae,* but periods of rising water levels are few and short and there is no clearing of the ground by the local inhabitants. The rise in the adult population of *gambiae* may be quite small and is of limited duration. If operation of density-dependent regulatory factors is sought, it is to be looked for in factors that limit the size of the outburst in May. Here there may be some overcrowding of larvae. It is difficult to envisage density-dependent factors operating at the reverse end of the scale, for since the eggs are laid in batches, below a certain level of adult numbers there is rarely more than one batch in any breeding site, and when this level is reached the degree of overcrowding of the larvae remains the same.

The Validity of the Premises

What evidence is there to support the seven premises assumed ?

1. That larvae are potentially able to complete development in the majority of sites which persist long enough. Overcrowding and shortage of food seem to be the factors that may prevent development in temporary sites. As suggested above, overcrowding is probably of most importance in restricting the extent of the seasonal rise. But, by contrast with the reproductive rates prevailing at all other times of the year, even though limited by overcrowding, the reproductive rate in this short period is impressively large. There is certainly no evidence of overcrowding in the dry season. Food shortage is assumed to be a relatively uncommon event for the reason that almost any site persisting long enough to permit development of larvae is found in a depression where it is the centre of a miniature drainage basin ; it receives a supply of debris washed in by ground water. Furthermore, in most cases such sites are not filled with water for the first time, but have had a previous history of being filled

for periods too short to permit development of larvae, but allowing population with algae. These algae leave resting forms which multiply rapidly when the depression is filled with water again. Furthermore, the food sources of larvae are complex, and include microorganisms living in the water, floating debris, both wind-borne and water-borne, and living material such as *Collembola* which gets stranded on the surface, and bottom deposits.

2. That predatory pressure is high in permanent and semi-permanent sites. Experimental demonstration of this has been given in type " B " sites for *gambiae* larvae by the author (CHRISTIE, 1958). It is difficult to assess how far these results can be used as a basis for general argument. In fact, attempts to explain adult population events of *funestus* in the same terms as those of *gambiae* at once reveal a serious logical difficulty. *A. funestus,* which breeds mainly in type " C " sites, achieves its highest population in August when the predatory fauna is fully established. These appear to be exactly the conditions that would be inimical to the survival of *gambiae* larvae. How then do *funestus* larvae survive? One possible explanation is that the growth of vegetation taking place in July not only excludes *gambiae* from ovipositing, but by obstructing the water surface, and so reducing the proportion of larvae swimming freely over the surface, reduces the loss of *funestus* larvae from predators. A model for this idea exists in the experiments of Gause with *Paramecium caudatum* and *Didinium,* an account of which is given by ALLEE *et al.* (1949). On the other hand it is also possible that the obstruction might reduce the mutual interaction of the predators, with the result that the density of predatory fauna per unit of water surface was increased, and at least compensated for the reduction in area searched by the individual predator.

   An alternative line of speculation is that a difference in behaviour between the two species makes *funestus* less likely to be eaten. A difference in the degree of spontaneous motility could go some way towards explaining this.

3. That temporary sites are free of predators. This assertion is reasonable. Though *Culex tigripes* is a highly effective predator of anopheline larvae, its distribution is sporadic. Apart from this species there are frequently no animals of such a size or feeding habit as could possibly be considered potential predators.

4. That unless water levels are rising, the majority of eggs will be stranded. All laboratory experience confirms this. In natural sites the slope of the " shore " is frequently very gentle, and therefore a small recession in the depth of water results in an extensive horizontal movement of the water line, and even if a proportion of the eggs are floating some distance from the edge, these get stranded as obstacles are revealed. Stranded eggs have been observed under the expected conditions in the field, but it was impossible to assess the significance of the numbers counted. In addition to losses from desiccation, it is possible that many of these stranded eggs are eaten by foraging ants and other animals.

5 and 6. That *gambiae* will not oviposit in water with dense emergent vegetation, while *funestus* favours sites of this type. The only recorded observations on oviposition are by THOMSON (1945), and these do not

point to the assumptions made here. There are, however, considerable difficulties in the inference of oviposition habits from records of egg collections, and these have been discussed by the author (CHRISTIE, in press).

7. That swamps persisting several months after the rainy season "stagnate" and conditions become such that survival of *funestus* larvae is low. There are 2 features of the environment involved in this process of stagnation: the formation of a surface film by bacteria, and deoxygenation and other chemical processes in the body of the water.

   An observation by THOMSON (1945) may explain the significance of film formation. He observed a pit in which *gambiae* appeared to be laying regularly. The surface was covered with scum, but no larvae appeared until the scum was broken up by rain. The eggs were evidently prevented from hatching by the existence of this film. This mechanical effect alone could explain the decline of the *funestus* population after August.

   It is not possible to state *a priori* that larvae cannot live in such waters. There appears to be no reason why an animal such as an anopheline larva, which obtains its oxygen direct from the atmosphere, should be affected by a deficiency of dissolved oxygen. This subject has not been properly explored. WANG (1938) measured the survival time of various species of larvae with and without their anal gills. In two experiments in which access to atmospheric air was prevented by paraffin, *Anopheles hyrcanus* var. *sinensis* died very much more quickly than *Culex pipiens*. Even if the oil is assumed to have been completely non-toxic, the experimental conditions do not resemble those obtaining in nature, where larvae are obtaining a continuous supply of atmospheric oxygen. When reduced oxygen tension in the water was obtained by evacuating the atmosphere over the container, *A. hyrcanus* actually survived longer than *C. pipiens* at the lower tensions according to WANG's table 4, although the opposite is stated in the text. UNTI (1943) found that some species of anopheline larvae were unable to survive in water of low oxygen tension taken from a stream. But low oxygen tension is only one of the properties of stagnant or polluted waters, and the inability of larvae to survive might be due to the CO_2 tension, or even the presence of specific compounds toxic in small concentrations.

Methods for the Further Investigation of the Premises

This review of the assumed premises shows that many of them are inadequately based on established fact. Further enquiry is required, both into the extent of survival of the three immature stages, and into the causes that determine the extent. The conventional methods of study, which at best can only determine the extent of survival, will be considered first. BATES has advanced (1941) and applied (1949) an argument for deriving information about the chances of survival of larvae from the relative abundance of the instars. He argues that if there is no mortality among the larvae, and oviposition has been taking place at a constant rate for the period covering the development of the mature larvae, larvae of the four instars will be present in proportion to their duration. Departures from these ratios, in particular a depression of the ratio IV/I, will indicate the extent of this mortality. Actually

the necessary assumption with regard to the eggs must be that they are *hatching,* not being laid, at a constant rate. Apart from this assumption there are many others implicit in the method, which may not be justified:

(a) that the method of catching the larvae, *e.g.,* by dipping, does not discriminate between the instars;

(b) that the action of searching has no influence on the rate of hatching;

(c) that the risk from predators is evenly spread over the instars.

The first point has never been investigated. The reverse of the second is probably true; ripe eggs stranded near the water line will hatch when covered with water washed over them by the disturbance caused in searching for larvae. Nor is there any reason to suppose that the third assumption is true. A small animal that normally preys on Crustacea can be envisaged as being able to capture only first-stage larvae. If, then, mortality in subsequent stages was not very great, the ratio IV/I would be high, and give an entirely false picture of the chances of survival. Analogous considerations might apply to the fourth stage larvae; in this case their greater size and motility would render them attractive as prey to larger animals for whom younger, smaller larvae would hold no interest. The fourth stage occupies a longer time than any other instar (about 40% of the total period) so that there is a fair chance of observing a positive ratio IV/I which appears to represent a substantial reproductive rate, when the actual chance of surviving to pupation is small. Boyd (1930) refers to Carter's distinction between complete and incomplete breeding places. The ratio IV/I measured in an incomplete breeding place is meaningless.

The importance of all three immature forms in determining the reproductive rate was emphasized above by setting out the relationship in symbolic form. This method of Bates is only concerned with the determination of the quantity L. A measure of the quantity A, that is the product of the chances of survival through the three immature stages, could be made if the number of newly emerged adults in a day were compared with the numbers of eggs presumed to have been laid, say, 9 days previously. This estimate does not appear to have been made, but various methods have been tried for determining the new emergences. Cambournac (1939) determined the numbers of pupae of *A. maculipennis atroparvus* per unit area of water surface in rice fields in Portugal. By assuming a figure for the mortality of mature pupae and emerging adults, it is possible to estimate the output of new adults per unit area. Grainger (1947) determined the output of *gambiae* from a unit area of rice field by means of a large cage. Gillies (1954a) has worked out methods for the recognition of newly emerged females from internal characteristics.

These observational methods, derived from the methods of making malaria surveys, can at best only suggest causes of changes in survival of immature stages. If studies of anophelines are to continue to bear fruit they must progress to the analytical stage, and methods for making the analysis must be devised. Observation alone cannot explain population events. Two of the premises detailed concern oviposition habits, and studies of these might be considered to have reached this stage of analysis. But, even in this case, the published field studies have been based on collecting methods which record presence, and presence-not-detected, and have been erroneously treated as sampling methods from which the total number of eggs present can legitimately be inferred.

No simple formula can be put forward for making these analyses. In constructing the hypothesis presented here a certain set of problems has been defined, and concrete proposals for investigations which appear practicable, rather than those which are theoretically most desirable, are now made.

1. The great variability of temporary sites makes their experimental study in the field difficult. On account of the complex nature of the food supply of anopheline larvae, these sites cannot be treated as simple soil-water cultures and studied in the laboratory. A close examination of the course of development of the rudiments of the adult organs, the elongation of the body and the accumulation of reserves, and their mutual time relations within the instars, made under various experimental conditions, might make it possible to infer conditions of life in the field from internal evidence. Some observations on anatomical changes within the instars have been made by JONES (1953). The accumulation and distribution of reserves have been studied by WIGGLESWORTH (1942).
2. The extent of predation in pools formed in a drying river requires attention. It is to be expected that pools forming in a river which has been flowing for a few months would have a rich fauna which would include several predatory species. Yet this condition of pooling appears to produce a peak output of *gambiae* in some regions. It may be that there is a tendency for the predators either to aestivate, or to retreat to the larger pools, when the river ceases to flow. Smaller pools might be amenable to investigation on the lines developed by the author (CHRISTIE, 1958). Vigorous collection of the other fauna could also show whether an obvious anomaly exists.
3. The absence of predation, other than by *C. tigripes,* should be confirmed by collections. These must be complete collections to ensure that any animals above a certain size limit are taken.

4, 5 and 6. Progress in the experimental investigation of oviposition behaviour in the field, and study of the fate of eggs, are made possible by the methods described by the author (CHRISTIE, 1958, in press). Assessment of the activity of ants in removing stranded eggs could be made by putting out counted numbers of eggs in two experimental sites, and surrounding one with an ant-proof trench.

7. To elucidate the problems of survival in swamps it is necessary to find some method of making a study of the fate of larvae in type " C " sites. An experimental approach requires a way of isolating part of the environment so that the fate of a counted number of introduced larvae can be followed, and predators rigorously excluded. The enclosure of an area cuts off the low velocity flow which prevents the formation of a surface film. Removal of all potential predators by manual methods involves baling and scraping which alter the character of the site completely. Progress with the problem of removing the predators might be made with one of the new water-soluble phosphorus insecticides which are rapidly degraded to non-toxic derivatives in the field. Recovery of all the fauna from a given area requires the making of an enclosure that is temporarily almost water-tight. This is virtually impossible in a well established swamp, and the first investigations of these problems should be made in grassy swamps growing on ground recently cultivated for rice.

The Seasonal Abundance of Anophelines in Other Regions

The close connexion between the abundance of *gambiae* and of rain, and the persistence of a high sporozoite rate in the dry season, support the idea that events in the aquatic phases of the life cycle play an important part in the seasonal control of adult numbers. Yet this conclusion is the opposite of that reached by BATES and DE ZULUETA (1949) in a study of seasonal fluctuations in anophelines in Colombia. A different mechanism may be at work in the two regions, but Bates and De Zulueta were hardly justified in reaching the conclusion they recorded. The weaknesses inherent in the method of studying the larval instar ratio have already been discussed, but the method employed by these authors to measure this ratio must also be questioned. It appears from their published data that fourth instar larvae only were identified, and that the specific composition of the total catch for the other instars was assumed to be the same as for the fourth instar. In other words they assumed that when a species was poorly represented by fourth stage larvae, it was equally poorly represented among the first stage larvae. It is not surprising that this method of smoothing the data led the authors to the conclusion stated. It should also be noticed that the site was artificially made. Although it was visited for oviposition by four species of *Anopheles,* it may not have been a representative site for all four species.

RUSSELL and RAO (1941) concluded from their study of *A. culicifacies* in borrow pits in India that decreased breeding of *culicifacies* was due to ageing of the pits. Such a method does not distinguish between decreased survival of larvae and decreased attraction of ovipositing females. It seems probable that they greatly underrated the effect of predation, since the effect of this cannot be gauged from the numbers of fauna seen by inspection, as they suggest. It is reasonable to assume that population of the pits would take a certain time, and initially the only active predators would be the immigrant mature forms of *Notonecta* spp. and other insects. Subsequently these mature forms would breed, and with active predation of all instars of *culicifacies* larvae in progress, the numbers of larvae would fall to a very low level. The general picture of population events of *A. culicifacies* presented by Russell and Rao, in particular that of a population decline while adequate breeding sites exist, presents striking parallels with that of *gambiae.*

A brief examination of the literature suggests that interesting parallels with the problems of *gambiae* and *funestus* might be presented by *punctulatus* and *farauti,* respectively, in the Far East.

In conclusion, the best prospects for immediate advance are by way of what has been called experimental ecology, in this case the experimental analysis in the field of the chances of survival of eggs, larvae and pupae. It is important that experimental ecology should employ the methods and restrictions of experimental science, and involve more than the creation of ecological niches in places where observation happens to be convenient. The nature of the experimental method requires that all such investigations should start with a stringent assessment of the accuracy of the method of study to be used.

SUMMARY

It is well known that the numbers of adult *A. gambiae* show marked seasonal fluctuation. In general the peak of population is found at, or near, the time

of the main rains, but the connexion of the population level with rainfall is not a simple causal one. Nevertheless there is reason to suppose that the cause of these fluctuations is to be found in changes of the chances of survival of the eggs, larvae and pupae, rather than of the adult mosquitoes. A brief survey of some of the literature of ecology shows that established theory cannot be held to predetermine the causes of mortality of these young stages, for the time scale of this enquiry is short and it is not necessarily concerned with the ultimate explanations of the numbers of *A. gambiae* found in Africa, but with their immediately observable fluctuations. Observation and experiment have led to the conclusion that a coherent scheme explaining population events can be based on 7 premises concerning eggs, larvae and the oviposition habits of the females. The annual cycle of events in a particular village in the coastal belt of Tanganyika, in an area of hyperendemic malaria, is explained in terms of these premises. Their validity is then examined and methods for their exploration are considered. Finally, some published accounts of seasonal fluctuation of anophelines in other parts of the world are considered.

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SUMMARY OF RECENT ABSTRACTS*

III. MALARIA†

[Continued from p. 268]

Treatment

HUSAIN *et al.* (p. 1302) report on Azacrin, a member of the acridine group, which appears to be an effective schizontocide.

Metabolites of proguanil and of compound 5943 were tested by ROBERTSON (p. 371), who found activity against various stages of the common human parasites, but who concludes that they are rapidly excreted or destroyed and are less suitable than the parent substances for the treatment of malaria.

HASKINS (p. 980) describes a simple qualitative test for chloroquine in urine. An overdose can be fatal, and HARRIS (p. 9) describes 3 cases in which young children were fatally poisoned by intramuscular injection of doses 2–4 times as great as the recommended doses. Exfoliative dermatitis in a patient who had been treated with chloroquine for rheumatoid arthritis is reported by GRANIRER (p. 1075).

YOUNG (p. 1201) comments on 3 cases of intense discoloration of the skin associated with the taking of amodiaquine.

CHARLES (p. 980) examined the effect of single doses of chloroquine and amodiaquine to control parasitaemia in semi-immune persons in a holo-endemic area of Nigeria where *P. falciparum* predominates. There was no distinct difference between the drugs and it was found that a single dose of 100 mgm. of the base of either was enough to clear the blood of parasites within 3 days and to keep it clear for 3 weeks, the density of crescents declining almost to extinction. In comment Walters regards this as a very practicable form of drug prophylaxis for a semi-immune population.

BRUCE-CHWATT and CHARLES (p. 247) tried chloroquine naphthoate (chloroquine embonate) for the treatment of Nigerian children with malaria. It is tasteless, but this advantage is quite outweighed by the fact that the results

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* The information from which this series of summaries has been compiled is given in the abstracts which have appeared in the *Tropical Diseases Bulletin*, 1958, v. 55. References to the abstracts are given under the names of the authors quoted and the pages on which the abstracts are printed.

† For previous articles on malaria in this series, see the March and April issues of the *Tropical Diseases Bulletin* each year since 1939.

obtained were much inferior to those achieved with chloroquine sulphate. Similarly, in Tanganyika, CLYDE and SHUTE (p. 982) found chloroquine methylene hydroxynaphthoate much inferior to the diphosphate, and note (see p. 1201) that its effectiveness is still further reduced by simultaneous administration of an antacid.

In African children treated by CLYDE (p. 982) with chloroquine and pyrimethamine for 2 consecutive days in an area where transmission was minimal, the infection (*P. falciparum*) was probably radically cured. A single dose of 600 mgm. chloroquine [presumably base] associated with 50 mgm. pyrimethamine was used by RAFFAELE and CARRESCIA (p. 627) for the treatment of 11 patients undergoing malaria therapy for neurosyphilis, 9 with *P. vivax* and 2 with *P. malariae*. Fever and parasitaemia disappeared quickly, and though anophelines fed on 4 patients before treatment all became infected, only those fed on one of these patients after treatment did so. YOUNG and BURGESS (p. 728) found that a single dose of 25 mgm. pyrimethamine in patients infected with *P. vivax* was enough to render them non-infective for anophelines for up to 11 days.

CLYDE *et al.* (p. 628) used a single dose of pyrimethamine (25–100 mgm. according to age) in an epidemic of malaria (almost all *P. falciparum*) in Tanganyika, and this brought the parasite rate down from 85% to 3%. A second dose was given to 107 labourers one month later, but again not quite all were cleared of parasites; it cannot be assumed, however, that this was due to drug resistance.

In Panama HOEKENGA (p. 481) used Propoquin in the treatment of *P. falciparum* and *P. vivax* infections, and the immediate and late results were good, comparing favourably with those produced by the other 4-aminoquinolines.

Some action of a preparation of diamino diphenyl sulphone (DDS) on malaria in a few cases is indicated by work reported by TARABINI (p. 731), which may be relevant to malaria in leprosy patients.

Suppression

DAVEY and ROBERTSON (p. 127) investigated the prophylactic power of a drug (No. 5943) which is related to proguanil, and found it valuable against *P. falciparum*. The drug is also useful in treatment and like proguanil it prevents the development of oöcysts in the mosquito stomach; it is rather more active and persistent than proguanil. In experiments on hitherto uninfected men they found that proguanil protected 6 of 10 who were subjected to repeated bites of *A. gambiae* infected with a proguanil-resistant strain of *P. falciparum* from Malaya. The protective action appears to be exerted on the exo-erythrocytic stages, and it seems that a strain exhibiting marked resistance therapeutically may be controlled in a great measure prophylactically. Where proguanil is used prophylactically it is advisable to use other drugs such as chloroquine for treatment. In work on volunteers infected with Malayan and African strains of *P. falciparum* by mosquito bite they (p. 732) showed that a daily dose of 50 mgm. chloroquine base was a satisfactory suppressive.

FAIRLEY *et al.* (p. 731) report the work they did during the war on the value of chloroquine diphosphate as a suppressive. In volunteers this produced results identical with those given by mepacrine; both suppressed *P. vivax* and radically cured *P. falciparum* infection by virtue of schizontocidal action on erythrocytic parasites and not by any direct action on exo-erythrocytic forms.

In Liberia MILLER (p. 10) conducted several large investigations on suppression of malaria in Africans by monthly doses of pyrimethamine with or without chloroquine and concludes that in this way it is possible to lower the parasite rate and reduce malarial attacks for long periods. He thinks that resistance of *P. falciparum* to pyrimethamine is probably rarer in Liberia than in East Africa. It has been suggested that resistance of *P. malariae* to pyrimethamine is likely to develop when dosage is inadequate, but YOUNG (p. 9) reports 6 cases in which it developed after suppressive doses greater than those recommended had been given.

In a field trial in Africa where malaria is holo-endemic CLYDE and SHUTE (p. 733) gave weekly doses of pyrimethamine (6–50 mgm. according to age) to Africans after a preliminary treatment with amodiaquine. They found that *P. falciparum* did not completely disappear, and after a few months its incidence rose, and full courses of treatment with pyrimethamine were now ineffective. Chemical tests indicated that the drug had been taken, and the conclusion therefore is that resistance to it had developed. Resistant parasites spread to untreated persons, and the authors think that resistant gametocytes must therefore be viable. In experiments on prophylaxis with pyrimethamine in the eastern part of Tanganyika CLYDE (p. 482) found that evidence of resistance soon appeared in *P. falciparum,* but in similar experiments in another district far to the west this did not happen, and the drug remained an effective protection. He (p. 1075) reports resistance of *P. falciparum* to pyrimethamine in 3 non-immune Europeans in Tanganyika, and notes that they lived near a tea estate on which resistant forms had previously appeared in African labourers.

Control

MACDONALD (p. 229) has published a book on the epidemiology and control of malaria in which he has used a mathematical technique to measure and correlate the various factors involved in transmission. With this as a basis he discusses the various means of control. The book clarifies the complex issues involved, but makes appropriate allowance for the variable factors, and is a valuable contribution to a difficult subject.

WILSON (p. 129) draws attention to the continuing need for planning the prevention of malaria in all relevant engineering enterprises in East Africa, including the construction of dams, irrigation schemes, roads, railways, etc. Consultation with health advisers is essential at all stages.

The 6th report of the meeting of the Expert Committee on Malaria of WHO (p. 248) held in 1956 dealt with eradication, and described in some detail the mechanisms which will probably be adopted in most eradication schemes. Details should be sought in the original, but it may be noted that most schemes will be based on campaigns against adult mosquitoes, with larvicidal work in special circumstances; the committee is chary of mass therapeutic campaigns combined with the insecticidal attack. Eradication is conceived as an intensive but brief attack on a well defined objective, and for this reason it differs from the conception of control. Unlike control, therefore, an eradication programme may not always be capable of integration with other insect-control programmes, and this may explain why, in this publication, there is no stress on the importance of correlation with engineering [see Wilson, above]. The WHO report on the Malaria Conference at Athens in 1956 (p. 628), which dealt with Europe and the eastern Mediterranean, brings out the fact that eradication

has been achieved in Italy, Sardinia, Sicily, Corsica, Crete and Cyprus. Campaigns are well established in various other countries, and resistance to insecticides is thought to be the only major obstacle, though there are minor obstacles, such as transmission by firmly exophilic mosquitoes such as *A. sergenti*.

WILLIAMS (p. 1202) traces the concept of eradication of malaria back to Hoffman who propounded it in 1916. Most people at that time regarded eradication as impossible, but it was eventually accepted, and the author gives an account of its history and the progress made to implement it.

SERGIEV and RASHINA (p. 983) describe the progress of malaria control in U.S.S.R. up to 1957. Control was reasonably successful before the war, but then the position deteriorated. After the war the campaign was based on insecticides and drug prophylaxis, and these measures, carried out by more than 2,000 malaria stations with large medical and scientific staffs, have been very successful, and an indication of this is given in a table showing the reduction in incidence in the various republics from 1940 to 1956.

Malaria control in the Pakistan army appears to have reduced the incidence from 105·5 per 1,000 in 1949 to 17·5 in 1955 (REHMAN and MAJID, p. 624).

MORONES PRIETO (p. 371) and ROMERO ALVAREZ (p. 372) describe the methods of control adopted in Mexico. In the *Gaceta Médica de México* (p. 985) there is an account of a symposium on the campaign to eradicate malaria in Mexico. The papers presented sum up their subjects in general terms.

BURNETT (p. 251) has continued studies of residual insecticides in East African huts. DDT is most active on non-absorptive walls, but BHC can act in the vapour phase after absorption, and dieldrin is intermediate between the two. Smoke from wood fires rapidly renders dieldrin ineffective, though BHC is not affected. For malaria control he recommends BHC for places with a short, sharp transmission season, DDT for places with a longer season, especially with labour forces difficult to protect from the toxic hazards of dieldrin, but for very intense malaria with a long transmission season he advocates dieldrin, especially if the aim is eradication.

The Malaria Section of WHO (p. 248) has issued a statement on information received on the susceptibility of various anophelines to insecticides; details should be sought in the original.

Malaria has for many years been imported into the Netherlands by people returning from malarious countries, and KRAAN (pp. 4, 124) shows that, to lessen the chance of spread in that country, the houses in which the disease occurs when imported cases are reported are treated with DDT, and when autochthonous cases occur, attempts are made to trace the sources of infection. Extensive tests on *A. maculipennis typicus,* in an area near Rome in which DDT spray has been used for many years, have shown no indication of developing resistance, though RAFFAELE and COLUZZI (p. 734) note that the mosquitoes appear still to be sensitive to the irritant action of DDT, which tends to drive them out of the sprayed houses before they get a lethal dose. RAFFAELE *et al.* (p. 986) quote experiments which indicate that *A. m. atroparvus* are more readily killed by DDT when several are exposed to it together than when exposed singly, and also that *A. stephensi, A. m. atroparvus* and *Aëdes aegypti* are more susceptible when old than when young.

Experience of antimalarial campaigns in Greece indicates that the original insecticidal attack should be extremely thorough, with heavy dosage in all parts of the area, and this should be maintained for a sufficient length of time—often over 4 years. BELIOS (p. 249) thinks that this could be combined with limited larvicidal programmes. Finally there must be efficient appraisal of results, and there may be a place for chemotherapy or chemoprophylaxis in the last stage of surveillance. He cites some of the reasons for the persistence of residual foci. In Greece there is still a little residual malaria, almost entirely due to *P. vivax,* but although the general level of infection has been very greatly reduced for many years, BELIOS (p. 250) observes that there is a strong continuing immunity to that parasite. HADJINICOLAOU (p. 250) describes the results of tests of susceptibility of certain Greek anophelines to chlorinated insecticides; great variations were observed between species and within species in different places.

In Turkey outbreaks of malaria were at one time traced to anopheline breeding in rice fields, and a law was introduced to enforce the drying of rice fields every 10 days, but this was never completely successful. PEK (p. 1303) shows that since the residual insecticides were introduced and treatment was given to all persons with malaria, rice cultivation has ceased to be a danger. The chief vectors, *A. superpictus* and *A. sacharovi,* have not shown resistance to the chlorinated hydrocarbons.

ESCUDIÉ and ABONNENC (p. 1202) comment on the exophilic habit of *A. gambiae* in part of Senegal where DDT had been widely used, and they conclude that this is not a fundamental change in behaviour but a result of repellance following irritation if the mosquito alights indoors on a treated surface.

Annual applications of DDT to houses, and considerable antilarval work in the early stages of a campaign started in 1952, have reduced the infant parasite rate from 49% in 1952 to 2·5% in 1957 in a valley of Ruanda-Urundi; MEYUS and BERVOETS (p. 862) did not find any sign of resistance in the mosquito population. [One of the anophelines named in the abstract is *A. maculipennis*; this is an error for *A. maculipalpis*.]

SOEIRO (p. 483) reports on malaria in Mozambique, where in one area a campaign of spraying with DDT or BHC has reduced the hospital admission rate for malaria to one-third of its former figure. *A. gambiae* and *A. funestus* are the vectors.

The susceptibility of *A. culicifacies* to DDT has been measured in many parts of Bombay State and RAMACHANDRA RAO and BHATIA (p. 484) conclude that even in regions sprayed for 8 years there has been no significant lowering of susceptibility.

In Kanara, a district of Bombay, malaria control by DDT was started early, and after 10 years the malariometric indices had fallen to zero and *A. fluviatilis* had disappeared. PATEL *et al.* (p. 630) explain that spraying was therefore stopped and a system of surveillance was instituted. This was quite adequate and it failed to reveal any renewal of malaria; the technique of surveillance is described, and would probably be suitable elsewhere in India.

An experiment in the control of rural malaria in Malaya, carried out in 1948–52, is reported by EDESON *et al.* (p. 630). DDT and BHC were used, with proguanil prophylaxis in one place. The vector was *A. maculatus,* which normally rests outdoors, and may therefore evade the insecticides. Complete

control was not obtained, but there was considerable reduction of malaria. The authors think that there might be some advantage in combining mass treatment (not prophylaxis) with the application of insecticides.

In 1921 the population of the atoll of Outong Java was found to have been very greatly reduced since a previous census estimate in 1907, and this disaster was attributed to the introduction of respiratory diseases and malaria; there was no improvement in the position, and malaria was found to be hyperendemic in 1951. HOLLINS (p. 129) shows that recently a mosquito eradication campaign has been highly successful, and *A. farauti* and malaria have been practically eliminated. The methods used included residual spraying and various measures against breeding.

In an oil settlement in New Guinea malaria control is achieved by using large quantities of oil as a larvicide, and by filling and draining the swamps (DE ROOK, p. 631). In 10 years incidence has fallen from 27% to 0·3% of the employees.

In the annual report of the Malaria Division of Trinidad and Tobago (p. 10) it is stated that almost every house is sprayed once each year with DDT, and that bromeliad malaria is controlled by spraying the host plants of *A. bellator* with copper sulphate and the manual removal of the epiphytes where possible. Measures against mosquito larvae are also taken in selected areas.

LABRECQUE *et al.* (p. 1303) tested several organophosphorus compounds against *A. quadrimaculatus*. Malathion was equal to or better than DDT throughout the experiment of 180 days; Diazinon and Dow ET-57 were better than malathion at first but not so good later; Dicapthon, chlorthion and dipterex were less effective than malathion.

MCNEEL (p. 1304) has found dieldrin effective against *A. albimanus* and *A. pseudopunctipennis* in Mexico where the walls of the buildings are of mud. There has been no evidence of rapid reduction of activity of the insecticide.

A. punctimacula is an important vector in Central America, and RONNEFELDT (p. 252) shows that in spite of its rather strong exophilic habit, 2 or 3 applications of DDT to dwellings greatly reduced its power to transmit malaria in hill regions of Colombia.

Investigating DDT resistance in a colony of *A. sundaicus* maintained in London DAVIDSON (p. 484) found evidence suggesting that it was transmitted hereditarily and indicating a single gene for resistance, which is virtually recessive. The heterozygote resembles the susceptible homozygote, and this type of resistance will take longer to develop in the field than one based on a dominant character.

D'ALESSANDRO *et al.* (p. 1076) examined the chromosomal arrangement in *A. m. atroparvus* resistant to DDT, and found it inverted in a higher proportion of these than of normal mosquitoes. A heterozygous inversion isolates a block of genetic material by causing a failure in crossing over, and the genetic factors in this block are thus transmitted as a unit to the offspring. The authors suggest that this type of resistance is inherited in this way, the homozygous orders allowing a scattering of the favourable factors during crossing over. KUHLOW (p. 629) failed to induce resistance to DDT and dieldrin by exposing larvae of laboratory colonies of *A. stephensi* and *A. m. atroparvus* to these insecticides, and concludes that these small inbred colonies did not contain genetic material capable of developing resistance. DAVIDSON (p. 1078) studied the resistance to DDT of *A. stephensi* exposed in the larval stage or the

adult stage, or alternately in successive generations. The increase in resistance was moderate, and was much less than the specific resistance observed in the field in Saudi Arabia. The resistance is probably a form of " vigour tolerance " which may depend on various non-specific factors inherited by multiple genes, and these changes will probably revert to normal in colonies maintained without selection pressure from exposure to insecticide.

During the control campaign in Western Sokoto, Northern Nigeria, resistance of *A. gambiae* to insecticides became apparent, and transmission of malaria continued, though not as freely as in the control areas. *A. gambiae* and *A. funestus,* however, were not as prevalent in areas treated with DDT as in those treated with BHC and dieldrin, and no infected specimens were found in those areas though common in BHC and dieldrin areas. BRUCE-CHWATT *et al.* (p. 863) report on this resistance, and on the detection of a gene of resistance in some areas where insecticides had not been used. DDT and dieldrin have been used extensively in the neighbourhood of Bobo-Dioulasso, French West Africa, and HAMON *et al.* (p. 1077) now report that resistance to dieldrin has been found in *A. gambiae,* but not resistance to DDT. In the French Cameroons no resistance was found by LIVADAS *et al.* (p. 1078) in wild-caught *A. gambiae* and *A. moucheti* exposed to DDT, BHC or dieldrin by the Busvine-Nash method.

high degree of resistance of *A. subpictus* to DDT is reported by SHARMA and KRISHNAMURTHY (p. 864) near Delhi, but there was no cross resistance to BHC or dieldrin.

Having observed that the DDT and BHC campaigns in French Guiana, though eradicating *Aëdes aegypti* and *A. darlingi,* had little effect on *Culex fatigans* and *A. aquasalis,* FLOCH and FAURAN (p. 1079) tested the resistance of the two last to DDT and BHC. *C. fatigans* showed resistance, but *A. aquasalis* was very susceptible; it probably escapes contact with residual insecticides because of its exophilic and zoophilic behaviour.

A. culicifacies, A. subpictus and *A. annularis* breed in association with aquatic vegetation in a reservoir in India, and this vegetation cannot be controlled by varying the water level, but NEOGY *et al.* (p. 252) have used certain herbicides with success for the purpose.

Malaria of Mammals

Monkeys

Mosquito transmission of *P. knowlesi* has been successfully accomplished by HAWKING *et al.* (p. 372) who used *A. stephensi* and *A. maculipennis atroparvus* and gave PABA and vitamins of the B group to both monkeys and mosquitoes to stimulate sporogony. *P. knowlesi* is infective to man, and the disease may in fact be a zoonosis. GARNHAM *et al.* (p. 734) found that *A. stephensi* was an unsuitable host and they passed it through *A. aztecus,* and they describe the oöcysts and the pre-erythrocytic stages in the liver of monkeys infected by injection of large numbers of sporozoites. RAY (p. 373) studied the pathological processes of the liver in monkeys infected intravenously with trophozoites of the Nuri strain of *P. knowlesi.* These went on to lobular necrosis and this was probably due to active venous constriction. Necrosis is not a constant feature until infection reaches about 60%, and it can to some extent be prevented by blood transfusion; he therefore argues that anoxia may be the stimulant for the constrictor effect. He (p. 1204) gives an account of the blood

picture in normal *Macaca mulatta* and in these monkeys when infected with *P. knowlesi*. He noted that in *P. cynomolgi* infection a poor diet reduced the intensity of the infection, retarding growth of the parasites, but the mortality rate in the monkeys was increased. He describes estimations of faecal and urinary urobilinogen in malarious monkeys.

MOHIUDDIN (p. 736) describes a new strain of *P. inui* isolated from a monkey in Malaya.

GARNHAM and BRAY (p. 735) inoculated sporozoites of *P. cynomolgi* into monkeys immune to the corresponding blood forms and observed that the number of schizonts found in the liver was less than in non-immune animals. Exposure of sporozoites to immune serum before inoculation into non-immune animals had no effect. In immune and control animals the numbers of pre-erythrocytic schizonts vary from animal to animal, and the authors conclude that the influence of immunity on pre-erythrocytic schizogony is probably nil or negligible. Monkeys are resistant to infection with sporozoites of *P. vivax*.

BANO (p. 632) shows that infection of *A. stephensi* with the microsporidian *Plistophora culicis* interferes with the growth and development of *P. cynomolgi* in the mosquito.

BRAY (p. 12) describes the development of gametocytes of *P. reichenowi* in Liberian chimpanzees, and (p. 13) has been able to demonstrate the 1-day pre-erythrocytic stage of *P. cynomolgi* in *Macaca mulatta*. At this stage the parasite is a round and uninucleate body within the parenchyma cell of the liver. He describes also the later stages of development.

Rodents (P. berghei and P. vinckei infections)

SERGENT and PONCET (p. 373) fed 3 white rats on the viscera and muscles of white mice infected with *P. berghei*, and one rat became infected. Similarly, SATYA PRAKASH (p. 1080) succeeded in infecting albino rats with *P. berghei* administered by mouth. This may be a form of transmission with practical implications since rats fight each other, and may also eat insects sucking blood from infected animals. SERGUIEV and DEMINA (p. 867) show that susceptibility of young rats to *P. berghei* is determined by the state of immunity of their mothers, and that resistance is increased if the young are suckled by the resistant mothers rather than by normal females. Rats which survive an acute attack of *P. berghei* infection may remain resistant to reinfection. It is conceivable that this resistance might be an expression of premunition resulting from the continued persistence of a few parasites, but CORRADETTI and VEROLINI (p. 255) have shown that parasites cannot be found either in the blood or (by inoculation) in the spleens of such animals and they therefore argue that this is true residual immunity, probably persisting throughout life.

From work on *P. berghei* and *P. knowlesi* in rats and monkeys respectively WOODRUFF (p. 130) concludes that malaria stimulates the production of gamma globulin in the blood, presumably in part by inducing the formation of antibodies, and that this effect is not immediate but takes place slowly over a period of months, and that reinfection may enhance it.

VON BRAND and MERCADO (p. 1080) report quantitative and histochemical studies on the liver lipids of rats infected with *P. berghei*, which are increased.

DEEGAN and MAEGRAITH (p. 1304) used radio-active iron to trace its metabolism in rats infected with *P. berghei*. The results indicated that equilibrium of administered iron was attained in normal animals in 10–20 days. In infected

animals the blood ^{59}Fe fell, but rose on recovery; ^{59}Fe increased in the liver, but returned to normal on recovery; it increased in the spleen, but in the kidneys the content varied widely and in the bone marrow there were indications of active turnover.

CARRESCIA and ARCOLEO (p. 254) investigated the virulence of a strain of *P. berghei* which had been losing the capacity to produce rapidly fatal infections in mice, and found that virulence could be increased by rapid passage and heavy dosage. They (p. 255) observed the weights of spleen and liver in chronic and acute infections.

SATYA PRAKASH (p. 374) examined the role of casein in the diet on the immunity acquired by mice infected with *P. berghei,* finding that it favoured the growth of the parasite and also the development of immunity.

In mice infected with *P. berghei* and fed on a diet containing 5% cod-liver oil, multiplication of the parasites is completely suppressed, but GODFREY (p. 485) points out that if adequate amounts of vitamin E and the water-soluble vitamins are added, multiplication takes place as well as in the controls. He discusses the mechanism of this effect. Similar effects with cod-liver oil were observed in *P. gallinaceum* and *S. duttoni* infections by TAYLOR (p. 1305). ADLER (p. 632) shows that an exclusively meat diet protects mice against the usual lethal action of *P. vinckei,* but that administration of PABA reverses this action. Mice (infected or not) kept on this meat diet eventually develop severe anaemia, which can be prevented or cured by administration of liver.

GREENBERG and KENDRICK (p. 737) discuss experiments on the inherited ability of mice to control parasitaemia in the first week after infection with *P. berghei,* and describe characteristics of *P. berghei* passed in inbred strains of mice.

Irradiation of rats shortly after inoculation of *P. berghei* appeared to have some effect in reducing parasitaemia, but VERAIN and VERAIN (p. 866) show that the action was on the host animals rather than on the parasites.

By treating mice infected with *P. berghei* with small repeated doses of chloroquine so as to convert the infection to a chronic type CARRESCIA and ARCOLEO (p. 256) have been able to produce evidence of some degree of acquired immunity to reinfection. *P. berghei* is normally fatal to white mice, but COX (p. 866) has shown that treatment with mepacrine may allow the development of acquired immunity to the infection.

Failure to produce resistance to chloroquine in a number of different plasmodia has been reported, but RAMAKRISHNAN *et al.* (p. 374), by giving very small doses continuously through 33 passages of *P. berghei,* have been able to produce a substantial degree of resistance.

Adult rabbits are immune to *P. berghei,* though baby rabbits less than 24 hours old can be infected. FABIANI and ORFILA (p. 868) have been able to show that rabbit erythrocytes can be invaded by the parasite and, on this and other evidence, that the immunity can be ascribed to humoral factors.

Malaria of Birds

STOHLER (p. 375) describes the course of infection of *P. gallinaceum* in the gut of *Aëdes aegypti.*

In an important paper on clones BISHOP (p. 1081) reports that she infected chicks with single trophozoites of *P. gallinaceum,* about one-third of the chicks becoming infected. These were then used to infect others, and metachloridine

was given for 3½ days after infection. Resistant parasites were obtained after 3–5 courses of treatment with 0·1 mgm. per 20 gm., and the resistance was retained after passage through mosquitoes and for at least 43 days in the absence of drug. In general the dosage of drug and the size of the inoculum were not important factors, and the author concludes that resistance could be due to mutation followed by selection.

RUDZINSKA and TRAGER (p. 256) report electron microscope studies of the fine structure of *P. lophurae*.

TRAGER (p. 375) describes his experiments on the substances needed by *P. lophurae,* freed from its host red cell, to survive in culture media, and gives a list of some of them. JORDAN (p. 738) discusses resistance to *P. lophurae* in various birds ; the course of infection and developmental pattern are determined by the species of bird, and this fact should be taken into account in experimental work. JACOBS (p. 257) observes that ornithosis confers a high degree of resistance to *P. lophurae* in ducklings.

Azaserine is an antibiotic with a wide range of action against micro-organisms, and it has an effect on *P. lophurae,* but MCCARTHY *et al.* (p. 14) have been unable to determine its mode of action.

In ducklings splenectomy does not appear to influence the course of *P. circumflexum* infection, but it produces much higher parasitaemia in *P. elongatum* infections, though it does not disturb the innate resistance which some ducklings show (MANWELL *et al.*, p. 257).

The effect of splenectomy on *P. rouxi* infection in canaries is described by CORRADETTI and VEROLINI (p. 1306). Splenectomy reduced survival and the incubation period, and increased parasitaemia in most birds, but not all.

POLIZZI SCIARRONE (p. 258) found that chickens had an innate resistance to an Italian strain of *P. praecox,* though this had not been apparent with a strain used by Manwell in America. He discusses the implications of these strain differences.

BALL and CHAO (p. 633) report some growth of excised oöcysts of *P. relictum* from *Culex tarsalis* in artificial culture, but sporozoites never developed.

The blood parasites of *Passer domesticus* in the United States are detailed by MANWELL (p. 739). *Charles Wilcocks*

MALARIA

In this section abstracts are arranged as far as possible in the following order:—Human malaria—*epidemiology, aetiology, transmission, pathology, diagnosis, clinical findings, treatment, control;* Animal malaria—*monkeys, other animals, birds.*

CANALIS, A. & SEPULCRI, P. Il malaere e le febbri intermittenti in Venezia dominante e nelle isole lagunari. [**"Malaere" and Intermittent Fevers in Venice and Lagoon Isles**] *Ann. d. San. Pubblica.* Rome. 1958, Sept.–Oct., v. 19, No. 5, 1051–63. [21 refs.]

The English summary appended to the paper is as follows:—

"In the light of papers by various physicians, the authors demonstrate that malaria was well-known in Venice, even though 'intermittent fevers' were classified as being different from 'malaere' with its 'pestilential fevers'.

"The authors are of opinion that malaria in Venice, because of a lot of factors, including improper statistics, did not have an adequate place among the data on spreading out of malaria in Italy."

CANALIS, A. & SEPULCRI, P. La prima inchiesta ufficiale sulla malaria (1849) in Venezia e provincia. [**The First Official Survey on Malaria (1849) in Venice and its Province**] *Ann. d. San. Pubblica.* Rome. 1958, Sept.–Oct., v. 19, No. 5, 1033–49, 1 folding map. [16 refs.]

The English summary appended to the paper is as follows:—

"The authors report the data concerning a survey carried out within the province of Venice, on order of the Austrian Headquarters, for the purpose of knowing the status of the 'so called malaria', even in relation to the months showing the highest incidence. Such data were afterwards confirmed through the survey conducted by the Senate when the bill on malaria was being examined."

DIAZ MARIN, J. Aportaciones a la epidemiología del paludismo en Marruecos. [**Observations on the Epidemiology of Malaria in Morocco**] *Archivos Inst. Estudios Africanos.* 1957, Dec., v. 10, No. 43, 7–89, numerous figs. [75 refs.]

In this treatise on malaria in Spanish Morocco the author divides the country into 5 regions. Data on temperature and rainfall for the regions are given and comparative figures for the incidence of malaria as well as data showing the downward trend of cases, from a total of over 17,000 cases in 1946 to a figure now varying between 300–500 annually. *P. vivax* malaria showed a fairly steady proportion in all cases between the years 1947 and 1950 at about 78%, but in the year 1949–50 *P. malariae* rose to 6·2% at the expense of *P. falciparum* malaria.

The entomological study of the region is summarized in distribution maps showing location of various anopheline and culicine species as well as lists of species recorded and notes on ecology.

The seasonal breeding density of *Anopheles maculipennis* and *Anopheles hispaniola*, the chief malaria vectors, are compared and the preponderance of *A. maculipennis* early in the year gives way to *A. hispaniola* after August until December.

After discussing the basis for future antimalarial work in Morocco the author concludes that *Anopheles maculipennis labranchiae* is the most important vector although *A. hispaniola* becomes increasingly important as its area of distribution is increasing. DDT was noted to have a very short residual action in the adobe houses of the area and the author emphasizes the urgent need for modifications in the type of insecticide programme. An appendix at the end of the paper sets out keys for the identification of mosquito larvae in Morocco. *E. R. Nye*

CIUCĂ, M., RADACOVICI, E., CHELĂRESCU, M., ATANASIU, M., IŞFAN, T., CONSTANTINESCU, P., TERITEANU, E., GIMA, I., SCARLAT, M., CONSTANTINESCU, G. & TĂUTU, L. Cercetări privind durata evoluţiei infecţiilor cu *Plasmodium vivax, Plasmodium falciparum* si *Plasmodium malariae*. **[Studies on the Duration of Infections by** *Plasmodium vivax, P. falciparum* **and** *P. malariae*] *Studii si Cercetări Inframicrobiol., Microbiol. si Parazitol.* 1958, v. 9, No. 1, 135–8. French summary.

In confirmation of previous experience, the duration of development of *Plasmodium vivax* and *P. falciparum* infections was not found to exceed 2 and 1 years respectively in Rumania.

In view of observations on *P. vivax* in Korean children arriving infected in Rumania, in whom the duration was shown to exceed 2 years, a period of 3 years has been established for measures to be used in treating proved cases. The duration of measures to be applied in the case of *P. falciparum* infection has been fixed at 2 years. In the case of *P. malariae* infections, only one observation is quoted. *H. J. O'D. Burke-Gaffney*

DIXIT, N. S. **Unusual Length of a** *Plasmodium ovale* **Infection.** [Memoranda.] *Brit. Med. J.* 1958, Dec. 27, 1578.

The period after possible exposure was 52 months, and appears to be the longest recorded.

LAIRD, M. **A Secondary Effect of DDT upon the Aquatic Microflora and Microfauna.** *Canadian J. Microbiol.* Ottawa. 1958, Oct., v. 4, No. 5, 445–52. [19 refs.]

In a laboratory study of the microflora and microfauna of wheat bran and yeast infusions for the rearing of *Anopheles maculipennis atroparvus,* a comparison was made of the effect of 2 μgm./ml. of DDT on the microbial population.

Bacteria, Protozoa and Rotatoria were studied and a succession noted as the culture medium grew older. This succession was found to be more rapid in cultures treated with DDT, apparently owing to rapid bacterial growth in dead mosquito larvae. Surviving mosquito larvae also developed more quickly owing to the abundance of food supply and were unaffected by heavy infestation with epibionts. Adults emerging from the control infusion were less robust than the counterparts exposed to DDT, owing presumably to greater inter-larval competition for a poorer food supply. The larvae were noted, in fact, to be less resistant to infestation in this group than in the group treated with DDT.

The need for field investigations into this question is emphasized.

E. R. Nye

SMITH, A. **Outdoor Cattle feeding and resting of** *A. gambiae* **Giles and** *A. pharoensis* **Theo. in the Pare-Taveta Area of East Africa.** *East African Med. J.* 1958, Oct., v. 35, No. 10, 559–67, 2 figs.

Large herds of cattle are kept in the Pare district of Tanganyika and in the Taveta district of Kenya. The cattle are enclosed out of doors at night, and in

one village about 90% of the feeding population of *Anopheles gambiae* were calculated to feed on cattle, and about half of these rested out of doors. In another village 60% of the females were calculated to have fed on cattle, and three-quarters of these rested out of doors. A number of *A. gambiae,* which had fed on cattle, were found resting inside huts during the daytime, but *A. pharoensis* is believed to rest mostly in vegetation out of doors. Most unfed *A. gambiae* were captured in cattle enclosures around midnight (12–1 a.m.), whereas unfed *A. pharoensis* were commonest at dusk. Comparison of the captures of fed and unfed mosquitoes throughout the night indicated that *A. pharoensis* fed almost immediately, but that *A. gambiae* delayed feeding for about 4 hours after entering the cattle enclosures.

[See also this *Bulletin,* 1957, v. 54, 917.] *B. R. Laurence*

Van den Assem, J. & Van Dijk, W. J. O. M. **Distribution of Anopheline Mosquitoes in Netherlands New-Guinea.** *Trop. & Geograph. Med.* Amsterdam. 1958, Sept., v. 10, No. 3, 249–55, 3 figs.

In a review of the anopheline species and their distribution in Dutch New Guinea the authors bring together their own and previous work upon the subject. 20 anopheline species are listed, with some notes on abundance and distribution, of which only 5 are common and widespread: *Anopheles farauti, A. punctulatus, A. koliensis, A. longirostris* and *A. bancrofti. A. farauti* is probably the main malaria vector in lowland regions. A difference was found between the northern and southern regions in that *A. punctulatus, A. farauti* and *A. koliensis* were dominant in the former while *A. bancrofti* and *A. farauti* were in the latter. Other regional differences were noted with a general trend for the anopheline population to become more prominent in the west to east direction. *E. R. Nye*

Pelikán, V. & Kvasnicková, D. Pozdní recidivy chronické malárie v průběhu jiných onemocnění. [**Late Relapses of Chronic Malaria in the Course of Other Diseases**] *Časopis Lékařů Českých.* Prague. 1958, Aug. 29, v. 97, No. 35, 1095–8. [31 refs.] English summary.

The authors have observed late relapses of malaria occurring in the Czechoslovakian hospital in Korea as a complication of some other disease. The patients had not suffered from malaria for a number of years, and the attack occurred at a time of year which precluded the possibility of reinfection. Brief histories of 9 patients are given in illustration, in which an attack of malaria occurred during the course of lobar pneumonia, spontaneous abortion, infective hepatitis, after surgical operations such as appendicectomy and subtotal gastrectomy, during the puerperium, and after lumbar puncture in a patient suffering from status epilepticus. *D. J. Bauer*

Schrier, S. L., Kellermeyer, R. W. & Alving, A. S. **Coenzyme Studies in Primaquine-Sensitive Erythrocytes.** *Proc. Soc. Exper. Biol. & Med.* 1958, Nov., v. 99, No. 2, 354–6, 1 fig. [17 refs.]

PILLE, G., LABÉGORRE, J., LAMBOURG, J. & LUNVEN, P. Intoxications volontaires à la chloroquine (Nivaquine) à Dakar (Sénégal). [**Suicide by Means of Chloroquine (Nivaquine) in Dakar, Senegal**] *Méd. Trop.* Marseilles. 1958, Mar.–Apr., v. 18, No. 2, 304–11. [23 refs.]

A young man committed suicide by taking large quantities of nivaquine. Death occurred from respiratory failure within two and a half hours. Autopsy revealed cyanosis especially evident in the extremities of the fingers. There were blue patches in the epigastric region resembling bruises. There was congestion of the duodenum and dilatation of the stomach vessels with petechial haemorrhages into the mucosa. The heart was flaccid and full of blood. The lungs were congested. [Surely the picture of shock ?]

Specimens of blood and urine were collected and samples were taken from various organs for examination. Among drugs found in the house was a bottle of nivaquine tablets.

Chemical analysis eventually revealed a 4-aminoquinoline in the urine, blood and tissues.

Intolerance appears in man at a plasma level of about 0·25 mgm. per litre (equivalent to 2 to 3 mgm. per litre of whole blood). The level recorded in this case was 180 mgm. per litre of whole blood, indicating the severity of the intoxication. The ratio of drug content of the liver compared to that of the blood with normal dosage is about 30 : 1 ; in this case it was 7·2 : 1 ; indicating that at this dosage the aminoquinoline was no longer concentrating in the liver, which was presumably " saturated ".

The total amount calculated to be in the urine, blood and viscera in this case was 5·86 gm. The mean concentration in the viscera was 1·2 mgm. per kgm., which was equivalent to an intake of at least 7·2 gm. Thus, there must have been 1·34 gm. in the muscles and extracellular fluid.

The suicide must have consumed something like 66 tablets of nivaquine, representing 100 mgm. of the base per kgm. (the toxic limit is usually given at 20 mgm. per kgm.).

The authors conclude that if taken in doses greatly in excess of those recommended, nivaquine is more toxic than mepacrine. Precautions should be taken regarding the indiscriminate distribution of nivaquine to the public.

B. G. Maegraith

NEMERY DE BELLEVAUX, J. & VANDERICK, F. Suicide par la Chloroquine. [**Suicide by Means of Chloroquine**] *Ann. Soc. Belge de Méd. Trop.* 1958, June 30, v. 38, No. 3, 553–6.

The English summary appended to the paper is as follows:—

" The authors report a case of suicide by taking 2·6 gm. chloroquine. A remarkable feature was the rapid evolution of the symptoms [about half an hour, with death in less than 2 hours]."

SOARES, R. ; PAULINI, E. ; PEREIRA, J. P. ; SOARES, R. M. [i] Da concentração e eliminação da cloroquina através da circulação placentária e do leite materno, de pacientes sob regime do sal cloroquinado [SOARES, PAULINI, PEREIRA & SOARES]. [**i. Concentration and Elimination of Chloroquine by the Placental Circulation and the Milk in Patients receiving Chloroquinized**

Salt] *Rev. Brasileira Malariologia.* Rio de Janeiro. 1957, Jan., v. 9, No. 1, 19–27. English summary. [ii] Da concentração e eliminação da cloroquina através de líquidos orgânicos de pacientes sob regime do sal cloroquinado [PAULINI, SOARES & PEREIRA.] [**ii. Concentration and Elimination of Chloroquine by Body Fluids in Patients receiving Chloroquinized Salt**] *Ibid.*, 29–49. [12 refs.] English summary.

i. Experiments have been made to prevent congenital malaria in the offspring of 3 groups of pregnant women (total 23) by giving doses of 45, 30 and 20 mgm. chloroquine base daily in food for 3 to 5 days before delivery. Estimation showed that in most cases the content of drug in the maternal and foetal blood was the same but could vary in either direction. In a similar way the drug was estimated in the milk of 3 groups, each of 6 patients, receiving the same doses of chloroquine as above, and was found to be present only in barely detectable amounts. It was considered nevertheless that the method of administration of the drug incorporated in salt was efficient.

ii. Estimations were also made of chloroquine in the serum and urine of groups of patients receiving the doses of drug noted above and likewise after a single dose of 300 mgm. drug followed by 20 mgm. daily. The detailed results obtained are given in a series of tables. There was considerable variation in the amounts of drug excreted by different people as well as in daily output. The percentage excreted was inversely proportional to the size of dose and was detectable for 7 days after administration ceased. Estimations on urine had practical advantages over those on serum. *J. D. Fulton*

SCHNEIDER, J., LANGUILLON, J. & DELAS, A. Association chloroquine-pyriméthamine dans la chimioprophylaxie du paludisme résultats après 22 mois de traitement. 2e Note. [**Chloroquine-Pyrimethamine Combination in the Prophylaxis of Malaria. Results after 22 Months of Treatment**] *Bull. Soc. Path. Exot.* 1958, May–June, v. 51, No. 3, 316–19, 1 chart.

In a previous communication [this *Bulletin,* 1957, v. 54, 1386] the authors gave details of an experiment carried out in a hyperendemic zone of northern Cameroons in which 250 village children were given a weekly dose of 75 mgm. chloroquine base plus 6·25 mgm. pyrimethamine, *i.e.*, half the therapeutic dose of each drug judged sufficient for a child by the Lagos Malaria Conference of 1955, over a period of 6 months. From the results it appeared that the two drugs at first acted as adjuvants to one another, but that during the latter part of the experiment resistance to pyrimethamine developed on the part of the parasite, thus rendering the combined regime ineffective.

The work now reported on was undertaken to verify this hypothesis. The children of the same village were now divided into 3 groups. Group A received the same weekly dose as before (75 mgm. chloroquine base plus 6·25 mgm. pyrimethamine). Group B received 25 mgm. pyrimethamine and Group C 300 mgm. chloroquine base, in each case double the recommended therapeutic dose.

The parasite index in Groups A and B as determined by monthly blood examinations over a 12-month period never fell below 6%. At the height of the malaria transmission season it rose to 35% in Group A and 21·8% in Group B. In Group C the figure remained considerably lower throughout the

year and at the time when those of the other two groups were at their peak it was only 5·4%.

The authors conclude that while the combination of chloroquine and pyrimethamine is very active for a time, its prolonged use is not to be recommended. If chemoprophylaxis is to be employed in an antimalarial campaign in a holoendemic area, the *whole* population should be included. If it is desired to treat only a section of the population, the dose administered should be that prescribed for individual prophylaxis.

Finally, it is recommended that pyrimethamine should not be used either alone or in combination with chloroquine when it is intended to carry out chemoprophylaxis in a particular region over a period exceeding 3 months.

G. Covell

World Health Organization. **Malaria Eradication. A Plea for Health.** 12 pp. 1958. Geneva: Palais des Nations.

WHO here sets out, and apparently for non-specialist consumption, the facts which led the World Health Assembly to inaugurate the policy of malaria eradication and to establish a Malaria Eradication Special Account as an international repository for funds contributed by governments and other sources to help in the eradication campaigns. The problem is that of malaria, which affects 1,100 million people exposed in 120 countries and acts as a drag on material development by the direct cost of treatment, by causing losses in manpower and the failures of potential land utilization and industrial development. The nature of eradication is stated, and its urgency is justified because of the development of resistance to insecticides by the anopheline, making eradication a race against time.

The visible needs during the next 5 years amount to an expenditure of about $600 million, about 55% of this coming from the countries concerned, about 35% coming from other sources such as U.S.A. and UNICEF funds, and 10% which must be obtained through the World Health Organization. To finance this a Malaria Eradication Special Account (MESA) has been created together with a Pan-American Health Organization Special Malaria Fund. The estimated expenditures from these funds are set out for the years 1958–1962 and classified according to the Region of expenditure, totals to the nearest million dollars being:— Africa 2, the Americas 16, South-East Asia 14, Europe 1, the Eastern Mediterranean 4, and the Western Pacific 6. With other inter-Regional, undetermined, and headquarter expenses the grand total is 48·5 million dollars. After 1962 budgetary requirements will diminish yearly and it is expected that they will be spread among more countries, several of which will already be freed from malaria and able to help both with finance and with skilled staff.

G. Macdonald

Jaswant Singh, Rao, B. A. & Ramakrishnan, S. P. **National Malaria Control Programme in India, 1953–1956.** *Indian J. Malariology.* 1957, Dec., v. 11, No. 4, 419–65, 2 maps. [17 refs.]

Programmes for a national scheme for malaria control, as opposed to local campaigns, were first proposed in 1946 and it was estimated in 1952–53 that roughly 200 million of India's 357 million people were exposed to malaria and about 15% of them were then receiving some form of protection. A much

elaborated scheme was incorporated in the Five-Year Plan which operated from 1953–54 onwards and under which 125 control units were established. Each of these was intended to protect about a million people, and would operate in a locality in which it was to apply 100 mgm. of DDT per square foot of wall surface once every 6 months during the transmission season for 3 years. Spraying was then to be ended and to be replaced by a programme of alert watchfulness. This scheme was largely financed from U.S. funds and the detailed proposals allowed for it being gradually brought into full operation so that at the end of the 5-year period most rural populations would be protected under it, while urban populations would receive protection arranged by the municipal authorities under subsidy from the Central Government. The arbitrary termination at 3 years was later discontinued, it being decided that spraying should be continued until, for 2 consecutive years, the child spleen rate fell below 5%, the parasite rate below 1% and the infant parasite rate to zero. When this level was achieved a surveillance mechanism was to be substituted for the spraying programme.

The authors critically review the working of this plan, pointing to the weaknesses which appeared and to the methods by which they might be overcome. On the credit side there is the very substantial fact that over 78 million houses have been sprayed during 3 years of operation. The reported incidence of malaria (clinically diagnosed) has decreased from 61 to 37 million per annum, and a check on these clinically diagnosed cases shows that the proportion with actual parasitaemia has decreased to about one-third of its previous level. The records analysed include changes in the spleen rate, but not the parasite rate, and entomological data collected by control units. These include records of the density of vector anophelines, of all anophelines, and of culicines in terms of catch per man hour. Analysis of these findings over a period shows the reduction which has followed control and the densities of anophelines which are associated with the transmission of malaria and with freedom from it. The critical densities which can be estimated from such material are summarized in terms of the hand catch per 10 man hours. For *Anopheles culicifacies* and *A. stephensi* the value is 33, for *A. fluviatilis, A. jeyporiensis* and *A. varuna* it is 4·0, for *A. minimus*, 0·8, and for *A. annularis, A. sundaicus* and certain combinations of vectors it is 13·0. [The residual insecticide reduces the longevity as well as the density of anophelines and thereby complicates the concept of a critical density.] *G. Macdonald*

TAIWAN PROVINCIAL MALARIA RES. INST.: WORLD HEALTH ORGANIZATION. **Malaria Team in Taiwan. Malaria Control and Eradication in Taiwan: Progress Report, May 1952 to June 1957.** *Bull. World Health Organization.* Geneva. 1958, v. 19, No. 4, 595–620, 4 figs. [18 refs.]

About 6·8 million of the 9·31 million people in Taiwan are exposed to the risk of malaria, which is carried predominantly by *Anopheles minimus minimus* and which occurs in some degree of intensity up to hyperendemicity in virtually all rural areas except the higher mountains. *A. hyrcanus sinensis* has previously been suspected as a subsidiary carrier on the basis of a single sporozoite finding in 965 dissected [see CHOW *et al.*, this *Bulletin*, 1953, v. 50, 475], but this single positive finding has since been shown to have been mistaken and to be one of crithidial infection.

Malaria control has long been practised. Residual insecticides were first widely applied under a joint National/U.S.A./WHO scheme aimed at control, which started in 1952 and by 1954 had protected 5·5 million people with a single annual application of 2 gm./m.^{2} of DDT. The scheme was then revised to aim at eradication. It was extended to protect 7 million people, it increased in efficiency, and the previously used DDT insecticide was reinforced by the addition to it of gamma BHC applied at 17 mgm./m.^{2} This combination was used to ensure a greater kill of insects other than anophelines and so overcome a growing public apathy in connexion with the scheme. In 1957 operations were restricted to previously hyperendemic areas with a population of 1·6 million and it is expected that in 1958 they will be restricted to areas with a population of 0·4 million people.

The results include the near disappearance of *A. minimus* and also of malaria, but in neither case is the disappearance absolute. Though not to be found in houses *A. minimus* persists and has been shown capable of surviving in woodland areas in the complete absence of man. Individual cases of malaria which may well have been contracted since the start of operations have been found in 84 " townships ". However, infections among children born since the start of operations have become extremely rare, 3 in 38,737 routinely examined in 1956, and most positive films are found in adults to whom attention had been directed by the presence of fever—112 of 10,785 such people in 1956.

After these discoveries, surveillance was increased by the creation of mobile malaria detection teams operating mainly in previously hyperendemic areas, which in 12 months produced 86 positive films out of 121,627 examined. 72 of these 86 were in adults with fever, 12 were in infants who had fever at the time, and only 2 came from non-febrile infants. There is a consequent strong implication for future planning that routine examination of infants at a late stage in the campaign may be very wasteful, and main attention should be paid to an active search for fever cases. Neither physiological nor behaviouristic resistance has been noted in the malaria vector or in head lice, cockroaches or fleas, but it has occurred in *Culex fatigans,* bed bugs and house-flies.

[This paper is specially interesting on account of its critical examination of the nature of positive foci in the later stages of the campaign and deserves study in the original by those concerned in eradication.] *G. Macdonald*

VARGAS, L., ROMAN Y CARRILLO, G. & ALMARAZ UGALDE, A. **Organization and Evaluation of the Malaria Eradication Campaign in Mexico during the First Year of Complete Coverage.** *Bull. World Health Organization.* Geneva. 1958, v. 19, No. 4, 621–35, 3 figs.

This paper consists mainly of a statement of mechanisms adopted in the campaign which was inaugurated in December 1955, and which in 1957 protected over 15 million people, with only a slight statement of the results achieved. More data concerning these results are presumably to be published later.

The basic unit is a " working area ", in each of which there is a team composed of a chief and 4 spraying officers capable of spraying 9,000 houses in a year of 250 working days. These working areas are the foundation of a pyramidal structure of sectors, sections and zones leading to the General Administration, under the Governing Body and the National Committee for

Malaria Eradication, with its accompanying administrative and technical departments, which are indicated on a chart. There is a special Evaluation Office at the highest level, the functions of which are here illustrated by a separate chart and a short descriptive account of each activity. They include evaluation of spraying operations, the amount of insecticide deposit, the insecticide specification, the residual effect achieved, and such matters as the evaluation of training, of epidemiological activities, health education and other matters. Indirect evaluation is carried out in the office by review and analysis of reports and quantitative data, and in the laboratory by parasitological, entomological and chemical examinations related to one or another aspect of the eradication campaign.

[For earlier references to this campaign, see this *Bulletin,* 1958, v. 55, 985.]

G. Macdonald

TRINIDAD GOVT. **Annual Report of the Malaria Division, Health Department, Trinidad & Tobago, 1957.** 77 mimeographed pp., 5 graphs, 1 map & 4 figs. [1958.] Port of Spain, B.W.I.

The malaria division of Trinidad and Tobago was formed in 1943, and annual reported malaria incidence soon dropped from around 20,000 to around 5,000 cases. At that level it remained until 1955, when intensification of effort resulted in a sharp fall, to 274 and 452 cases in 1956 and 1957. Notified deaths from malaria in 1957 numbered only 6. The accuracy of both morbidity and mortality figures should be regarded as dubious: few cases are reported from some areas known to have a comparatively high incidence. The slide diagnostic service, started in order to provide general practitioners with a speedy diagnosis, received fewer slides in 1957, but with nearly double the percentage of positives. An evaluation team started work during the year, examining blood smears from persons living in houses previously sprayed. All residents in any house in which a case was found were treated with 0·6 gm. of Camoquin or 100 mgm. of pyrimethamine.

In some areas in which *Anopheles aquasalis* was thought to be the main vector, *A. bellator* has been found to be equally important. In these, 0·5% copper sulphate was sprayed on immortelle trees to kill the bromeliads which provide breeding sites for *A. bellator.* So far transmission has not been completely interrupted in these areas. It appears that a very small *A. bellator* population can maintain transmission, and that malaria eradication in *bellator* areas must depend partly on chemotherapy.

A malaria eradication programme was begun in July, the intention being to achieve complete residual spraying with dieldrin at 0·5 gm. per square metre twice yearly in the *bellator* areas and 0·6 gm. per square metre once yearly in the *aquasalis* areas. Eradication measures in Tobago, which include much antilarval work, were continued. No blood slide has been found positive since 1953, though *A. aquasalis* has not been eradicated.

After a change to dieldrin as the main insecticide, and strict attention to 100% of breeding sites, there is every hope that *Aëdes aegypti* will soon be eradicated completely. Larvicide trials on *Aëdes aegypti* with 4 organophosphates, malathion, Diazinon, Dipterex and parathion, have been conducted, by the methods described by GILKES *et al.* [this *Bulletin,* 1957, v. 54, 159]. Of the 4. parathion was effective in concentrations of 0·001 p.p.m. Malathion was

the next best, being fairly effective at 1 p.p.m., and being less toxic to mammals would be the one of choice for field use.

After the development of DDT resistance by the bed bug, experiments showed the effectiveness of even short (15 minute) exposures to dieldrin. The mental hospital has remained free from bed bugs for a whole year after one spraying with dieldrin.

[Many subjects, including bromeliads, are discussed in great detail in this report. For 1956 Report, see this *Bulletin,* 1958, v. 55, 10.] *B. B. Waddy*

ELLIOTT, R. **A Method for the Investigation of Susceptibility to Insecticides in *Anopheles* Larvae.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1958, Nov., v. 52, No. 6, 527–34, 1 fig. [10 refs.]

Tropical species of anopheline mosquitoes may complete their larval and pupal development in 7 days, the fourth stage larva lasting only about 48 hours and the third stage only 24 hours or less. A period of exposure to insecticide lasting 24 hours, as in certain methods devised for testing the susceptibility of third or fourth stage mosquito larvae to insecticides (see, *e.g.,* World Health Organization Technical Report Ser. No. 153, 1958, p. 63 [see below, p. 491]), is considered to impose on such rapidly developing larvae starvation as well as toxic effects.

This paper describes a method tested against fourth stage larvae of a susceptible and a resistant strain of *Anopheles gambiae* and third stage larvae of a susceptible strain of *A. maculipennis atroparvus,* in which the exposure period was 1 hour and the readings of mortality were made after a further 5 hours in insecticide-free water. Mortality in controls was low; starvation effects were minimal. Concentrations of insecticide could be stronger than for longer exposure times. Concentrations used ranged from 0·001 to 40 parts per million in tests of susceptibility to DDT, gamma BHC, dieldrin, toxaphene, parathion, malathion, chlorthion and Diazinon. Although the dieldrin-resistant strain of *A. gambiae* was not killed by the strongest concentration of this insecticide, the test proved otherwise suitable. The pattern of response to the insecticides was similar for the susceptible strain of *A. gambiae* and of *A. m. atroparvus.* The resistant strain of *A. gambiae* was markedly tolerant (as noted above) to dieldrin; LC50 values were 3·7 and 0·8 parts per million for gamma BHC and DDT, respectively, compared with LC50 values of 0·045 and 0·064 parts per million for these toxicants in the susceptible *A. gambiae.* Differences in tolerance between these two strains of *A. gambiae* to the organophosphorus compounds are ascribed to vigour tolerance. Only one of them, parathion, indicates promise, from these laboratory assays, of being effective against the larvae of the dieldrin-resistant *A. gambiae*; the others were less toxic than DDT to both the resistant and the susceptible *gambiae* strains.

A graph of the spectra of responses of the three mosquito strains to the 8 insecticides, and several tables of data, supplement the text. *D. S. Bertram*

See also p. 491, WORLD HEALTH ORGANIZATION. TECHNICAL REPORT SER. No. 153. **Insect Resistance and Vector Control. Eighth Report on the Expert Committee on Insecticides, Geneva, 18–23 November 1957.**

DAVIDSON, G. **The Inheritance of Resistance to Insecticides in Anopheline Mosquitoes.** *Pest Technology.* Manchester. 1958, Oct., v. 1, No. 1, 23–4.

This brief article summarizes the findings, reported at length elsewhere [this *Bulletin,* 1957, v. 54, 124], for monofactorial resistance of an incompletely dominant nature to dieldrin and BHC in *Anopheles gambiae* of Nigeria; also DDT resistance in *A. sundaicus* of Java, which is recessive [*ibid.,* 1958, v. 55, 484]. The use of discriminating doses to determine the genetic nature of these resistance mechanisms is clearly explained. Some account is also given of the use of the minimum LD100 dosage to give an indication of the genetic basis of a resistance which is found in wild mosquito populations. *D. S. Bertram*

ARMSTRONG, J. A., RAMSDALE, C. D. & RAMAKRISHNA, V. **Insecticide Resistance in *Anopheles gambiae* Giles in Western Sokoto, Northern Nigeria.** *Ann. Trop. Med. & Parasit.* 1958, Oct., v. 52, No. 3, 247–56, 2 maps & 4 graphs.

Resistance to dieldrin in *Anopheles gambiae* in the Western Sokoto malaria control project was first indicated by tests made by ELLIOTT and RAMAKRISHNA in 1955 [this *Bulletin,* 1956, v. 53, 857]. A homozygous resistant strain of this species from this area was successfully colonized in London in 1956 and its spectrum of resistance to most of the common insecticides and the mode of inheritance of the resistance were worked out [DAVIDSON, *ibid.,* 1957, v. 54, 124]. Two discriminating dosages of dieldrin, one killing susceptible *A. gambiae,* but not hybrid or resistant strains, and the other killing hybrids but not resistants, were established.

Armed with this knowledge the authors of this paper surveyed the extent and prevalence of the three phenotypes of *A. gambiae* in and around the malaria control project area of Western Sokoto. In all the orginal areas sprayed with dieldrin alone or with BHC, and even in the extension areas more recently sprayed with BHC, the proportion of homozygous resistant *A. gambiae* was exceedingly high (around 90%). These persisting mosquitoes were shown to be still susceptible to DDT and in the DDT-sprayed area itself almost no *A. gambiae* could be found.

Of supreme interest was the finding of heterozygous *A. gambiae* in areas outside the control project even at a distance of some 50 miles from the nearest sprayed area, indicating that resistant *A. gambiae* are far from rare in unselected populations in this part of Africa. [An error on page 254, line 2, may be a source of confusion—" 6·0 per cent " should read " 0·6 per cent ".]

G. Davidson

ADAM, J. P., BINSON, G., BAILLY, H., EYRAUD, M. & HAMON, J. Présence du gène de résistance au dieldrin chez *Anopheles gambiae* Giles, en Basse Côte-d'Ivoire (A.O.F.). [**Presence of a Gene of Resistance to Dieldrin in *Anopheles gambiae* in the lower Ivory Coast, French West Africa**] *Bull. Soc. Path. Exot.* 1958, May–June, v. 51, No. 3, 326–9.

The authors have tested the susceptibility of larvae of *Anopheles gambiae* to dieldrin in parts of the lower Ivory Coast, using the method of 1 hour's exposure and 5 hours' observation described by ELLIOTT [see above, p. 418] instead of the technique described by WHO [see below, p. 491] which the

authors consider allows an excessive mortality in the control panels. For contrast purposes they have used larvae from two parts of the Upper Volta, one a typical homozygote susceptible strain and the other a typical homozygote resistant strain. The findings at La Bia in the lower Ivory Coast can only be interpreted as representing the existence of an almost exclusively homozygous strain in this area, where the first use of the insecticide was 10 months before the test. Results from the neighbourhood of Abidjan, somewhat vitiated by high control mortalities, indicate that a considerable proportion of the larvae were resistant. These observations extend the known boundaries of the distribution of the gene of resistance to dieldrin in *Anopheles gambiae* which has now been identified in Northern Nigeria, the Upper Volta, Liberia, and the Ivory Coast.

G. Macdonald

SHARMA, M. I. D. & KALRA, R. L. **Note on the Quantitative Estimation of the Degree of D.D.T. Resistance in *A. subpictus* Grassi, 1899 in Delhi State.** *Indian J. Malariology.* 1958, June, v. 12, No. 2, 93–100, 3 charts.

Adult *Anopheles subpictus* collected in Delhi State have been tested with the Busvine-Nash technique and shown to have a resistance of 50 times. This figure was obtained by comparing the MLC values from sprayed and unsprayed villages. An increase in tolerance to DDT between 1955 and 1957 in unsprayed villages suggested an influx of a fairly large proportion of individuals with low DDT susceptibility from sprayed villages nearby. The larval resistance measured with the WHO kit was low: 2 to 4 times. But it is considered, from the slope of the log. concentration probit regression line and the magnitude of the adult MLC, that this is a case of true physiological resistance and not " vigour tolerance ".

[See also this *Bulletin,* 1958, v. 55, 864.] *R. J. Wood*

SEN, P. **Studies on the Effects of DDT Residual Spray on Malariometric Indices.** *Indian J. Pub. Health.* 1957, Apr., v. 1, No. 2, 113–17.

A variety of combinations of dose and cycle of DDT have been used in the control of malaria carried by *Anopheles philippinensis* in Bengal, and their effect is here judged by the changes in the spleen rate after the use of different treatments. It appears that transmission starts about July and continues for roughly 6 months. A late season spray in October/November is not conducive to an efficient malariometric reduction. A single massive dose of 112 mgm. DDT/sq. ft. applied as an emulsion early in the season or two rounds of suspensions at 90 mgm./sq. ft. proved, by this standard, to be the most effective treatment in cutting down the incidence of malaria. They were superior to suspensions and emulsions applied at the rate of 45 mgm. and 56 mgm./sq. ft. applied at 6- to 8-week intervals, which were virtually identical in their effects.

G. Macdonald

RADACOVICI, E., IŞFAN, T., IANCU, L. & DINCULESCU, M. Cercetări privind *Plasmodium berghei.* [**Studies on *Plasmodium berghei***] *Studii si Cercetări Inframicrobiol., Microbiol. si Parazitol.* 1958, v. 9, No. 1, 139–48. [27 refs.] French summary.

The authors, in Rumania, studied the biology and pathogenicity of *Plasmodium berghei* in 615 mice, all but 2 of which died, in 7 hamsters and in

young rats, all of which died, and in adult rats which showed different degrees of infection, but recovered spontaneously.

Rats surviving initial infection acquired an immunity lasting from 10 months (7 rats) to 19 months (3 rats). The immunity is transmitted by rats infected during pregnancy to their young *via* the milk. The young rats on reaching adult life and bearing young themselves (at 5 months old) retained their immunity but did not transmit it to their infected descendants and all of these died.

In one of 36 infant rats (progeny of 6 animals infected during pregnancy) infection occurred 8 days after birth: this congenital infection was acquired during parturition and not through the placenta.

Mepacrine, chloroquine and proguanil failed to cure infected rats in tolerated doses: pyrimethamine at a daily dose of 0·375 mgm./20 gm. body weight intraperitoneally and 0·300 mgm./20 gm. orally did not produce radical cure. Attempts to transmit *P. berghei* in the embryos of fowl and ducks was successful only in the case of 3 of 13 duck embryos, and only scanty young parasites were found. *H. J. O'D. Burke-Gaffney*

GREENBERG, J. & KENDRICK, Louise P. **Parasitemia and Survival in Mice infected with *Plasmodium berghei*. Hybrids between Swiss (High Parasitemia) and STR (Low Parasitemia) Mice.** *J. Parasitology*. 1958, Oct., v. 44, No. 5, 492–8, 2 figs.

This study, which is devoted to factors responsible for the degree of parasitaemia in mice infected with *Plasmodium berghei,* with special reference to the genetic control of resistance in the host, was carried out with Swiss and STR strains, their hybrids and backcrosses, while infected Swiss mice served as donors in all cases. The mice were inoculated intravenously at the age of 2 months, and the percentage of infected red cells was determined on the sixth day.

It was found that parasitaemia in hybrids of the first (F1) and second (F2) generations was significantly lower than in the parent Swiss mice but higher than in the STR parent, but the difference between F1 and F2 was not significant. In the backcross to STR mice the parasite counts were significantly lower than in the backcross to Swiss mice, though in the latter parasitaemia was lower than in the parent Swiss mice. As regards the survival of the mice, the patterns for F1 and F2 and backcross to STR were similar, but the backcross to Swiss mice survived for a shorter time. As a rule male mice had a lower parasitaemia than females.

[For previous studies by the authors, see this *Bulletin,* 1958, v. 55, 737 *bis.*]

C. A. Hoare

MOHAMMED, A. H. H. **Systematic and Experimental Studies on Protozoal Blood Parasites of Egyptian Birds. Vols. I. & II.** pp. xi + 298, 4 figs. & 13 pls. [Numerous refs.] 1958. Cairo University Press.

This monograph in two volumes is based on material obtained from birds caught in the vicinity of Cairo (chiefly from the Abu Rowash area) or from the Cairo zoo; a few domestic birds were also examined, while the main study was carried out in the Department of Parasitology of the London School

of Hygiene and Tropical Medicine. The survey embodied practically all months of the year and included 885 birds belonging to 63 species. A third of the birds were found to harbour blood parasites, including many mixed infections. *Haemoproteus* and *Plasmodium* were the commonest parasites, though the latter has a restricted host distribution; *Leucocytozoon* has a very low incidence and only 5 birds were found infected with this parasite; trypanosomes were uncommon (1·0%); *Atoxoplasma* was found in 7% of the sparrows; piroplasms were detected in one kestrel and in 3 nestling barn owls; microfilariae were found 6 times.

Part II contains a useful review of the classification and distribution of the piroplasms, and concludes with a detailed description of new forms found in birds. The author divides the piroplasms into 6 groups; (A) Babesia group with 5 genera, (B) Theileria group with 5 genera, (C) Anaplasma group with 3 genera, (D) Achromaticus group with 4 genera (including *Nuttallia*), (E) Aegyptianella group with 3 genera, (F) a miscellaneous group with 5 genera (as diverse as *Dactylosoma, Sauroplasma* and *Echinozoon* from amphibians, lizards and hyrax respectively) and (G) genera of doubtful nature. *Nuttallia shortti* is described from a single kestrel which was kept under observation for 39 days; the infection was transmitted to 2 other kestrels, but the canary failed to develop the disease; the morphology of the parasite is described in great detail. A similar piroplasm was found in 3 barn owls.

Part III gives a good summary of bird malaria and describes the incidence of the disease in Egyptian birds. *Plasmodium relictum* was found in 12 species of birds (including new host records) and differed slightly in character from species to species; *P. rouxi* was found in 4 species and *P. vaughani* 3 times in larks; an unidentified species was observed in a hoopoe.

Part IV deals with *Haemoproteus* and describes 4 new varieties: *H. danilewskyi* var. *cairogensis* in a crow, *H. cellii* var. *aegyptius* in the eagle owl, *H. lanii* var. *nucleophilus* in a grey shrike, and *H. herodiadis* var. *mathio-legeri* in the little bittern, besides other known and unknown forms. Part V contains an interesting account of the development of *H. columbae* in the pigeon fly *Pseudolynchia canariensis*. More than 250 flies in 30 batches were applied to infected pigeons; 120 flies were subsequently dissected, but oöcysts were found in only 13 flies, usually in small numbers—the largest one was $31\mu \times 25\mu$. Sporozoites were observed in 5 out of 42 flies dissected 10 days or more after they had fed; the sporozoites were on an average 7μ in length and $0{\cdot}8\mu$ wide. In the earlier experiments, the infection was successfully transmitted by flies to clean squabs, and 25 days after infection gametocytes began to appear in the blood and schizonts were numerous in the lung but scarce in the liver.

This is a well written and adequately illustrated monograph which will prove invaluable to anyone working on bird malaria in general. It possesses a good bibliography and index. *P. C. C. Garnham*

TRYPANOSOMIASIS

In this section abstracts are arranged as far as possible in the following order:—African—*human, animal;* American—*Chagas's disease and other trypanosome infections. In each form the following order is followed:*—*epidemiology, aetiology, transmission, pathology, diagnosis, clinical findings, treatment, control.*

See also p. 494, EAST AFRICA HIGH COMMISSION. **East African Trypanosomiasis Research Organization, Tororo. Report No. 8, 1956–57.**

GROSSOWICZ, N. & RASOOLY, G. **Evaluation of some Trypanostatic Agents by means of** *Herpetomonas culicidarum*. *J. Protozoology*. Utica. 1958, Nov., v. 5, No 4, 249–51. [13 refs.]

ROBSON, J. & CAWDERY, M. J. H. **Prophylaxis against Trypanosomiasis in Zebu Cattle. A Comparison of Prothidium, the Suraminates of Ethidium and RD 2902, and Antrycide Prosalt.** Reprinted from *Vet. Record*. 1958, Oct. 25, v. 70, No. 43, 870–76.

FAIRCLOUGH, R. & THOMSON, W. E. F. **The Effect of Insecticidal Spraying against** *Glossina palpalis fuscipes* **Newstead in the Nyando River Basin of Kenya.** *East African Agric. J.* 1958, v. 23, No. 3, 186–9, 1 map. [Summary taken from *Rev. Applied Entom.* Ser. B. 1958, Dec., v. 46, Pt. 12, 189.]

The numbers of *Glossina palpalis fuscipes* Newst. on two tributaries of the Nyando river in Kenya were greatly reduced in 1951–52 by hand-spraying of the vegetation from the river bed with DDT [*R.A.E.*, B **42** 25–26], and an extensive campaign, involving the rest of the river system, was carried out in the first half of 1955, when four applications of 5% DDT in an emulsified solution were made in the same way at intervals of a fortnight or a little longer if the weather was unfavourable. The numbers of *G. p. fuscipes* caught monthly during regular patrols carried out between March 1954 and December 1955 fell from 1,600–2,000 before the spraying began to a maximum of five after the completion of the four applications, but intensive surveys showed that the fly then occurred in the unsprayed upper reaches of the main Nyando river where it had not been found in the original surveys of 1949, and still persisted in parts of the tributaries sprayed in 1951–52, though in much smaller numbers than before the spraying. These infested stretches were sprayed, five times during the last half of 1955 and the first two months of 1956, again as nearly as possible at fortnightly intervals.

Only five flies were caught in the first eight months of 1956 and none between September 1956 and June 1957, although the regular monthly fly rounds were supplemented by intensive surveys in April–June and October–December 1956, and it therefore appeared that extermination had been achieved. The nearest place in which the fly was known to occur was 30 miles away.

The experience gained during the work showed that spraying is best carried out in the drier seasons, because heavy rain washes the insecticide from the

leaves and floods may make spraying from the river beds impossible, and also that the flies could be exterminated from inaccessible gorges by spraying at both ends of the gorge, which destroyed them as they left it in search of food. The costs of spraying increased from £42 per river mile in 1951 to £68 in 1955, but compared favourably with that of £300 for hand-clearing. In all, 137 miles of river were treated between 1951 and the end of the campaign.

ROSENBAUM, M. B. & CERISOLA, J. A. Encuesta sobre enfermedad de Chagas en la provincia de La Pampa. [**Survey of Chagas's Disease in the Province of Pampa, Argentina**] *Prensa Med. Argentina.* 1957, Nov. 29, v. 44, No. 48, 3485–93, 5 figs. [21 refs.]

ZELEDÓN, R. & VIETO, P. L. **Comparative Study of** *Schizotrypanum cruzi* **Chagas, 1909 and** *S. vespertilionis* **(Battaglia, 1904) from Costa Rica.** *J. Parasitology.* 1958, Oct., v. 44, No. 5, 499–502. [14 refs.]

"A biometric study is reported of *Schizotrypanum cruzi* (2 strains) and *S. vespertilionis* isolated from bats caught near San José, Capital of Costa Rica. For *S. vespertilionis* the nuclear index was 2·7 and the total average length was 16·0 microns and for 2 strains of *S. cruzi* the measurements were 1·5 for the nuclear indices and 21·4 and 21·5 microns for the average total lengths.

"A comparative table for both species with different biometric and biological characters is presented.

"Some discussion concerning the value of the average nuclear index is offered and a tentative position is given for the *Schizotrypanum* adequately described from bats in our continent."

DE LUCENA, D. T. Epidemiologia da doença de Chagas em Pernambuco. I—Distribuição geográfica dos Triatomíneos. [**Epidemiology of Chagas's Disease in Pernambuco, Brazil. I. Geographical Distribution of Triatomid Bugs**] *Rev. Brasileira Malariologia.* Rio de Janeiro. 1957, Oct., v. 9, No. 4, 537–57, 5 maps. [32 refs.] English summary.

A survey of over 18,000 houses was made to determine the distribution of triatomid bugs in the State of Pernambuco, Brazil. Of 15,653 specimens the following percentages of different species were obtained: *Panstrongylus megistus* (74·26%), *Triatoma brasiliensis* (18·85%), *T. rubrofasciata* (3·47%), *T. maculata* (3·32%) and less than 1% of *P. lutzi, T. melanocephala* and *T. sordida. P. megistus* is the most widely distributed species. *T. brasiliensis* occurs rather more frequently in houses of the inland, western region of the State than *P. megistus* although its numbers per house are lower than for the latter. In general the western region, which is the driest and warmest part of the State, is more suited to triatomid bugs than elsewhere. *T. rubrofasciata* is noted as having been introduced at the port of Recife in slave-trading times; it has spread only north-east in the coastal region. *T. maculata* had a patchy distribution throughout the territory.

The bugs were dislodged from resting places in houses by the use of dustings of pyrethrum in an inert powder.

Maps and tables supplement the text. *D. S. Bertram*

DEANE, L. M. & DEANE, Maria P. Notas sôbre transmissores e reservatórios do *Trypanosoma cruzi* no noroeste do Estado do Ceará. [**Observations on Vectors and Reservoirs of** *Trypanosoma cruzi* **in North-Western Ceará, Brazil**] *Rev. Brasileira Malariologia.* Rio de Janeiro. 1957, Oct., v. 9, No. 4, 577–95, 2 figs. [Numerous refs.] English summary.

Observations were made on vectors and reservoirs of Chagas's disease in the north-west of the State of Ceará, Brazil, in the course of studies primarily to investigate the epidemiology of kala azar. Of 1,257 bugs taken, the following percentages of 5 different species were obtained: *Triatoma brasiliensis* (73·5%), *T. maculata* (2·5%), *P. megistus* (20·1%), *P. lutzi* (0·4%) and *Rhodnius nasutus* (3·5%). *T. brasiliensis* was notably predominant in hot, dry semi-arid plains; *P. megistus* was more characteristic of cool, humid forested mountain regions. All 5 species occurred in valleys and foothills, only *T. brasiliensis, P. megistus, T. maculata* being found in houses and in caves and, with *R. nasutus,* in hen-houses. Shelters for domestic animals, unless very open, harboured numerous *T. brasiliensis* and *R. nasutus.* 7 of 118 *T. brasiliensis* and 1 of 10 *T. maculata* harboured *Trypanosoma cruzi.* Less than 25 specimens of other species were dissected and found negative. Only 2 out of 7 opossums (*Didelphys paraguayensis*) were positive for trypanosomes morphologically indistinguishable from *T. cruzi*; about 130 other mammals, of different orders, were negative.

The authors feel need for clarification of the status of trypanosomes of the *cruzi* type in wild animals. *D. S. Bertram*

KOEBERLE, F. Mucoembolia. [**Lymphatic Embolism by Intestinal Mucus**] *Rev. Goiana Med.* 1958, July–Sept., v. 4, No. 3, 221–9, 4 figs.

The English summary appended to the paper is as follows:—

"The author refers to a case of Chagas' disease with megacolon in which he disclosed an embolus of intestinal mucus into the lymphatic vessels of intestinal wall, coming at the mesenteric lymph glands.

"He shows several interesting morphologic and functional aspects occurring in the intestinal tube, namely in the formation of 'mega'."

LEISHMANIASIS

In this section abstracts are arranged as far as possible in the following order:—visceral, cutaneous, muco-cutaneous.

LUPAŞCU, G., CIPLEA, A. & GHERMAN, I. Contribuţii la studiul rezervorului de infecţie in focarul de leishmanioză din regiunea Craiova. [**Study of Reservoirs of Leishmaniasis in a Focus in the Craiova Region, Rumania**] *Studii si Cercetări Inframicrobiol., Microbiol. si Parazitol.* 1957, v. 8, No. 4, 647–51, 2 figs. on pl. French summary.

In 1955 the authors identified *Phlebotomus perfiliewi* for the first time in Rumania in a focus of leishmaniasis in the Craiova region [this *Bulletin,* 1957, v. 54, 1398]. They have now examined marrow punctures from 251 dogs in

a district in that area where most of the cases were found. Leishmaniae were found in the reticular cells of the marrow in 3 dogs.

Preparations of bone marrow, spleen and liver from the 3 infected dogs were inoculated in hamsters, and in the bone marrow of the infected hamsters leishmaniae were found intra- and extracellularly.

The appearances of the leishmaniae in the marrow of dogs and hamsters are shown in 2 photomicrographs. *H. J. O'D. Burke-Gaffney*

WU, Cheng-Chien. **Some Achievements on the Study of Kala-Azar in New China.** *Chinese Med. J.* Peking. 1958, Oct., v. 77, No. 4, 307–9.

There was a time when kala azar menaced the lives of large numbers of people and seriously affected agricultural production in China. Since the establishment of the present Government great attention has been paid to the treatment and prevention of this disease.

During the course of large-scale epidemiological surveys the bone marrow of 113,393 dogs was examined by ilium puncture in the 7 provinces where kala azar is endemic. In Kansu 90 out of 15,873 dogs were found to harbour leishmaniae. In east China the disease is not so common: out of 26,678 only 33 were positive. Observations on the blood preference of *Phlebotomus chinensis,* the important vector, showed by precipitin tests that an average of 12% contained blood of canine origin, while in Shantung only 1·8% fed on dogs.

In Kansu Province, kala azar occurs mainly in children and infants, with only a few infections in age-groups above 10 years. In east China the disease is found in higher age-groups. Sodium antimony gluconate is less effective in the treatment of kala azar in north-west China than in east China. Experimental therapy in hamsters infected with strains of parasites from these two localities gave the same result. This suggests that in China there exist two types of leishmania infections, one in the north-west which resembles the Mediterranean type, and one in east China which more resembles Indian kala azar.

In 1957, 2,955 wild animals, rodents and carnivores, were examined in Kansu Province with negative results.

Skin manifestations, especially of the nodular type, are rare. 25 cases have been reported in recent years. Most showed both visceral infection and skin manifestations, with or without fever, splenic enlargement or other clinical symptoms. Sometimes the skin manifestation occurred on the mucous membrane in the oral cavity.

To facilitate mass treatment and to effect a quick recovery, a 3-day course of 2 daily injections of antimony gluconate was tried in 265 cases. The immediate cure rate was 99·6%, while follow-up examinations one to two years after treatment showed only 4 cases of relapse among 114 patients seen.

Extensive surveys on sandflies have revealed 8 species hitherto unknown. Nevertheless, *P. chinensis* is predominant. After marked sandflies were released, 70% were located within a radius of 30 metres from the releasing centre, which indicates that the activity of *P. chinensis* is very limited. By placing 6 different domestic animals in caves and then examining the ingested blood by precipitin tests it was found that *P. chinensis* has a preference for donkeys and cattle.

Experiments on the spraying of insecticides have shown that DDT and gamma 666 [BHC] are highly effective. A single spraying of 1·5 gm. of the former or 0·12 gm. (gamma-isomer) of the latter per sq. m. suffices for control. However, the effect of DDT is more lasting than gamma 666. From studies made in selected villages a scheme for the eradication of sandflies has been formulated and put into practice. *Philip Manson-Bahr*

RODRIGUES DA SILVA, J. & DE PAOLA, D. O problema das fibroses hepaticas no leishmaniase visceral americana. [**The Problem of Hepatic Fibrosis in American Visceral. Leishmaniasis**] Reprinted from *Rev. Assoc. Med.* Brasil. 1958, Mar., v. 4, No. 1, 8–21, 13 figs. [27 refs.] English summary.

This paper also appeared in *Gaz. Méd. Portuguesa* [this *Bulletin,* 1959, v. 56, 24].

STAUBER, L. A., FRANCHINO, Elizabeth M. & GRUN, J. **An Eight-Day Method for Screening Compounds against** *Leishmania donovani* **in the Golden Hamster.** *J. Protozoology.* Utica. 1958, Nov., v. 5, No. 4, 269–73, 2 figs. [31 refs.]

Chemotherapeutic tests of drug activity against visceral leishmaniasis in hamsters are usually time-consuming procedures. The present communication in which an 8-day period for screening purposes is described should prove of great interest to those engaged in this type of work. The method is based on the fact that after intracardial inoculation of a suspension of *Leishmania donovani* from a donor animal a steady rise of parasites occurs in the spleen and liver of golden hamsters for some days. The authors had previously determined that 10 million parasites in 0·1 ml. volume suspension given directly into the hamster's heart regularly cause the appearance of parasites in the liver within 1 hour, in numbers which can be determined. Using 8 animals per dose of drug, the authors started treatment 24 hours after parasite inoculation, and the amount of drug, based on body weight, was given once daily for the 6 following days, generally by the intraperitoneal route. Pentostam was used as standard for comparison of results. On day 8 the animals were killed and impression smears of liver and spleen made for counting the parasites present. Observations were also made at intervals of 1 to 2 hours and 4 days after inoculation on the course of infection in untreated animals, as well as on the general pathology of the infection.

The results showed that compounds previously recognized as active against *L. donovani* in the hamster showed activity in the present test whereas inactive compounds did not. The authors point out, however, that the effect of slowly acting compounds or those in which a high level has to be built up might be missed by the method described. *J. D. Fulton*

FEVERS OF THE TYPHUS GROUP

In this section abstracts are arranged as far as possible in the following order:—general; louse-borne typhus, flea-borne typhus, mite-borne typhus; rickettsialpox; tick-borne typhus; Q fever, other rickettsial diseases.

ROBLES GARNICA, R. Resultados de la campaña contra el tifo epidémico en la región Tzeltal-Tzotzil. [**Results of a Campaign to Control Epidemic Typhus in the Tzeltal-Tzotzil Region, Mexico**] *Bol. Epidemiológico.* Mexico. 1958, Jan.–Feb.–Mar., v. 22, No. 1, 19–28, 3 plans & 1 graph.

The Tzeltal-Tzotzil region covers about 2,400 square kilometres at 1,200 to 2,500 metres altitude in the Sierra de Chiapas mountains in Mexico. A population of about 100,000 people live in poor hygienic conditions, mainly in communities of 250. Temperatures are sub-zero in winter, and never much over 15°C. otherwise; humidity is high. Typhus cases occurred in each of the five winters before 1955, despite some treatments with DDT. An intensive programme, preceded by an educational campaign on hygiene, of treating clothing with 10% DDT in talc was carried out during the autumn of 1955 and spring 1956. Less than 4% of the people failed to co-operate. No cases of typhus occurred in the winter of 1955–56 and this freedom has persisted for 32 months since dusting began. Note is taken, however, of the fact that the incidence of *Pediculus humanus corporis* still amounts to 25% of the people in much of the region; this is an improvement on infestation rates of 51 to 100% for most of the region before the above campaign. There is need to guard against extension of re-infestation with concomitant risk of further outbreaks of typhus. *D. S. Bertram*

SASA, M. & OSADA, Y. **Additional Observations on the Appearance of some Bird-Parasitic Trombiculid Mites on the Rockhead by the Effect of Breath. (Studies on Tsutsugamushi, Part 102.)** *Japanese J. Exper. Med.* 1958, Aug., v. 28, No. 4, 289–91.

Larval trombiculids were collected on Miyake Island, north of Hachijo Island, Japan, from rocky resting places of the bird host *Monticola solitarius magnus*. Specimens of *Neoschöngastia asakawai, N. okuboi* and *Trombicula scutellaris* were collected on two beaches by using the attracting power of human breath [this *Bulletin*, 1958, v. 55, 143, 385]. Trapped rodents from forest areas (*Apodemus speciosus* and *Rattus norvegicus*) were carrying *Trombicula scutellaris, T. fuji* and *T. kitasatoi*: *A. speciosus* also carried *Gahrliepia saduski*.

The observations were made in February at a temperature ranging from 4–9°C. *E. R. Nye*

KIREEVA, R. A. **The Serological Diagnosis of North Asiatic Tick-Borne Typhus Fever.** *J. Microbiol., Epidemiol. & Immunobiol.* London. 1958, v. 29, Nos. 1/2, 235–8. [Translated from Russian.]

"(1) Agglutinin tests with *Proteus* antigen and complement-fixation tests with *Dermacentroxenus sibiricus* antigen are valuable methods for the laboratory diagnosis of North Asiatic tick-borne typhus fever.

"(2) In cases of tick-borne typhus fever a positive Weil-Felix reaction with *Proteus* OX2 antigen was observed in the first week of illness twice as often as with *Proteus* OX19 antigen (70 and 33·7 per cent respectively). At the end of the first month after the onset, the number of positive results with *Proteus* OX2 antigen had risen to 95 per cent and to *Proteus* OX19 to 75 per cent.

"(3) A considerable part of the patients (12 out of 20) retained agglutinins to *Proteus* OX2 in high titres for 2 years, which may be of importance for the retrospective diagnosis of this disease.

"(4) A positive agglutinin test with *Proteus* OXK and *R. prowazeki* antigen was found in a small number of cases only (7·4 and 9·9 per cent respectively) and such tests were observed as a rule only during the first 10 days of illness."

ANGELILLO, B., CORTICELLI, B. & MASIA, G. F. Sulla frequenza di anticorpi contro *C. burneti* in Sardegna. [**The Frequency of** *Rickettsia burneti* **Antibodies in Sardinia**] *Igiene Moderna.* 1958, May–June, v. 51, Nos. 5/6, 366–75, 2 figs. & 1 graph. [15 refs.] English summary (7 lines).

In an investigation of the incidence of Q fever in Sardinia complement-fixing antibody to the Henzerling strain of *Rickettsia burneti* in a titre of 16 or higher was found in the sera of 493 (43·3%) of 1,136 cattle and 308 (39·0%) of 789 sheep arriving at slaughterhouses, with maximum incidences of 46·9% and 48·0% respectively in animals coming from certain areas. Antibody was present in the sera of 39 (19·0%) of 205 persons working in exposed occupations (shepherds, slaughterers, dairymen), and in 8 (3·6%) of 220 persons not exposed to infection. *D. J. Bauer*

NIKHINSON, I. M., KAMUR, I. B. & SAVCHENKO, E. N. **Q Fever on Sakhalin.** *J. Microbiol., Epidemiol. & Immunobiol.* London. 1958, v. 29, Nos. 1/2, 215–18. [Translated from Russian.]

"(1) The occurrence of Q fever among cattle, domestic deer and field rodents confirms the existence of natural foci of this disease on Sakhalin.

"(2) The incidence of Q fever among human subjects bears a sporadic character and depends on contact with infected cattle."

PRORESHNAIA, T. L. & MISHCHENKO, N. K. **A Study of a Focus of Q Fever in the Issyk-Kul'sk District of the Kirghiz S.S.R.** *J. Microbiol., Epidemiol. & Immunobiol.* London. 1958, v. 29, Nos. 1/2, 218–23. [Translated from Russian.]

KULAGIN, S. M., FEDOROVA, N. I., BELAVSKII, E. B., ANASHKINA, L. I. & MARKARIAN, A. G. **An Outbreak of Q Fever in the Yaroslavl Oblast.** *J. Microbiol., Epidemiol. & Immunobiol.* London. 1958, v. 29, Nos. 1/2, 208–15, 2 figs. [Translated from Russian.]

DOLGOV, N. V. **An Outbreak of Q Fever in the Rossosh District of the Voronezh Oblast.** *J. Microbiol., Epidemiol. & Immunobiol.* London. 1958, v. 29, Nos. 1/2, 223–5. [Translated from Russian.]

"(1) In an outbreak of Q fever observed by us infection might have been due to contact with the wool of sheep (respiratory route) and also to consumption of raw cows' milk (alimentary route).

"(2) The characteristic symptoms of Q fever in the patients observed by us were as follows: acute onset, severe headache, profuse sweating, cough with signs of focal pneumonia (not in all cases), enlarged spleen and liver, bradycardia, slight leucopenia, high sedimentation rate, proteinuria, fall of temperature by delayed crisis, and general weakness continuing for some time. The duration of the febrile period varied between 1 and 3 weeks.

"(3) In view of the great variety of the symptoms of Q fever which resemble influenza, bronchopneumonia, enteric fever and in some respects typhus, the correct diagnosis can be established only by serological methods based on the reaction with the specific *Rickettsia burneti* antigen.

"(4) Agglutinins can be found in the blood of persons who have recovered from the disease over a long time (up to half a year, as long as we continued the observation)."

TJALMA, R. A. & SMITH, I. M. **Q Fever in Iowa Dairy Cattle.** *J. Amer. Vet. Med. Ass.* 1958, Dec. 15, v. 133, No. 12, 606–10, 1 fig. & 1 graph. [37 refs.]

"1) Of 11,779 bovine blood specimens tested in Iowa, 84 (0·71%) were found to be serologically positive for Q fever.

"2) An estimated 3·25 per cent of the herds tested were found to include 1 or more Q fever-positive animals.

"3) The incidence of bovine Q fever serological positivity, on both a herd and an individual basis, was observed to increase during the study period.

"4) *Coxiella burneti* was isolated from the milk of 9 of 63 serologically positive cows.

"5) Only one of 60 blood specimens collected from persons known to have had routine contact with serologically positive dairy herds was positive for Q fever."

KULAGIN, S. M., FEDOROVA, N. I. & SOKOLOVA, N. F. **The Survival of *Rickettsia burneti* in Water and Methods of Disinfection.** *J. Microbiol., Epidemiol. & Immunobiol.* London. 1958, v. 29, Nos. 1/2, 225–30. [12 refs.] [Translated from Russian.]

"(1) Study of the survival time of *Rickettsia burneti* in sterile water showed that it can survive for at least 160 days (time of observation); this confirmed epidemiological observations on the transmission of the causative organism of Q fever by water-borne infection.

"(2) Disinfection of water containing standard *R. burneti* material in a dilution of 10^{-3} can be achieved by a dose of 100 mg chlorine per litre in 30 min, by a dose of 50 mg per litre in 2 hr, and by a dose of 10 mg chlorine per litre water only in 10–12 hr.

"(3) Chlorination of water containing *R. burneti* in a dilution of 10^{-6} destroys the organisms within 10 min if the chlorine dose is 50 mg per litre, within 30 min in a dose of 20–10 mg per litre, and after 10–12 hr in a dose of 5 mg per litre. The disinfection takes more than 12 hr if the chlorine dose is 3 mg per litre, and if only 1 mg chlorine was added to 1 l. water the rickettsias did not die even after 24 hr."

REHN, F. **The Relationship between *Coxiella burneti* and some Ticks, with special reference to the Species *Ixodes ricinus*.** *J. Hyg., Epidemiol., Microbiol. & Immunol.* Prague. 1958, v. 2, No. 3, 300–13, 1 fig. [62 refs.]

A strain of *Rickettsia burneti* resembling the Henzerling strain was used. Guineapigs and mice were found to circulate rickettsiae 24 hours after inoculation to a titre of 10^{-4} and ticks were infected by feeding on such animals. Infection of ticks was demonstrated by inoculation into guineapigs. The ticks were maintained at 23·5°C. and a relative humidity around 90%. Infected larvae of both *Ixodes ricinus* and *Dermacentor pictus* were shown to give rise to infected imagos. The rickettsiae appeared to multiply especially during engorgement and during metamorphosis. Not all nymphs and imagos from infected larvae were infected. *R. burneti* was demonstrated in high titre in the faeces of infected *I. ricinus* and to a less degree in *D. pictus* especially during engorgement; 6 months later the faeces of the same ticks were non-infective. Transovarial transmission was demonstrated with both species but only a proportion of the progeny were infected. Transmission to guineapigs and mice by feeding infected imagos on them was demonstrated. The authors point out that animals may be infected by ingestion of infected ticks or inhalation of their faeces. Repeated feeding of infected ticks on an immune animal failed to affect either the proliferation or the virulence of the rickettsiae.

C. E. Gordon Smith

YELLOW FEVER

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, transmission, pathology, diagnosis, clinical findings, treatment, control.

BAROIAN, O. B. & LOZINSKAIA, T. M. **The Epidemiology of Yellow Fever.** *Problems of Virology.* London. 1958, v. 3, No. 1, 1–9, 4 figs. [12 refs.] [Translated from Russian.]

A general and historical review.

HAYES, G. R., Jr. & TINKER, M. E. **The 1956–1957 Status of *Aedes aegypti* in the United States.** *Mosquito News.* 1958, Sept., v. 18, No. 3, 253–7, 2 figs.

The northward spread of sylvan yellow fever in Central America, as far as the southern border of Mexico, combined with the presence of *Haemagogus*

equinus in Texas [this *Bulletin,* 1956, v. 53, 1231], adds emphasis to the risk of a yellow fever epidemic in southern states of the U.S. after the introduction of infected persons, animals or mosquitoes and in areas where *Aëdes aegypti* occurs. A survey of 17 states in the south-eastern region of the U.S. and centred on 65 towns was carried out. In several cases increased breeding of *Aëdes aegypti* was found where figures for previous surveys were available; in spite of this the distribution area of the mosquito appeared to be decreased when compared with earlier data. An eradication campaign would have to cover an area of about 1,000 by 300 miles according to the results of this survey. *E. R. Nye*

LAAKE, E. W. **Yellow Fever Vectors in Dallas, Texas.** *J. Econom. Entom.* 1958, Oct., v. 51, No. 5, 743–4.

The epizootic of yellow fever in monkeys from Panama northward since 1948, and records for *Haemogogus equinus* breeding at Brownsville in southern Texas [this *Bulletin,* 1956, v. 53, 1231], indicated that tree-hole-breeding mosquitoes should be surveyed in the area of Dallas in Texas. This was done throughout the year May 1957 to April 1958. Species taken breeding in tree-holes were *Aëdes triseriatus, A. zoosophus, Culex quinquefasciatus* [*C. p. fatigans*], two species of *Orthopodomyia, Toxorhynchites rutilis* and *Anopheles barberi.* Except for *Culex,* none are known vectors of human disease. It is concluded that *H. equinus* is not present; but it is known that *A. aegypti* breeds throughout much of the year in Dallas city and would serve to spread urban yellow fever if the virus was introduced. This is thought to be most feasible *via* southern Texas. Emphasis is given to the need for *A. aegypti* control in the U.S.A. *D. S. Bertram*

FRANCO, O. A febre amarela no continente Americano. [**Yellow Fever in the American Continent**] *Rev. Brasileira Malariologia.* Rio de Janeiro. 1957, Oct., v. 9, No. 4, 567–75. [11 refs.] English summary.

This article reviews the problem of yellow fever in relation to Brazil, with brief reference to the position in other parts of the continent. No foci of *Aëdes aegypti* have been found in Brazil since 1955. Surveillance for re-introduction from other countries must be continued. Periodic epizootics extend from the Amazon to central and southern Brazil; no means of preventing these events is known. Protection of the human population, particularly in enzootic areas, by vaccination should be continued, and also the viscerotomy service to detect silent yellow fever foci. *D. S. Bertram*

RABIES

MÖBEST, H. Ein experimenteller Hinweis zur Frage der Temperaturempfindlichkeit des Virus fixe Pitman-Moore. [**Experimental Findings on the Sensitivity of Fixed Virus (Pitman-Moore) to Temperature**] *Arch. f. Hyg. u. Bakt.* 1958, Dec., v. 142, No. 8, 581–7. [11 refs.]

The English summary appended to the paper is as follows:—

"Freshly prepared material containing virus fixe retained its full virulence in dilution up to 10^{-4} when the diluted suspensions were kept at room temperature, and up to 10^{-2} when the diluted suspensions were incubated at 37° for 24 hours."

STARKE, G. & SEIDL, S. Experimentelle Untersuchungen zur Frage der Hämagglutination des Tollwutvirus. [**Experimental Investigations on the Possibility of Haemagglutination by Rabies Virus**] *Ztschr. f.d.g. Hyg. u. ihre Grenzgebiete.* Berlin. 1958, Jan.–Feb.–Mar.–Apr., v. 4, Nos. 1/2, 118–23. [11 refs.]

In experiments with horse, bovine, pig, dog, cat and human group A, B, O and AB red cells attempts were made to obtain specific haemagglutination with infected material [presumably mouse brain] containing the Pitman-Moore, Novi Sad and Standard Challenge strains of fixed rabies virus. Agglutination occurred only with sheep and rabbit red cells; normal mouse brain extracts also agglutinated the same cells, and the effect was evidently unspecific. The red cells from the other animal species could not be rendered agglutinable by treatment with papain. Chick and rabbit red cells treated with papain were agglutinated by extracts of the brains and torsos of chick embryos infected with the Flury strain of rabies virus, but not by extracts of the chorioallantoic membrane or yolk sac; the effect was again unspecific, since it was also produced by uninfected materials. *D. J. Bauer*

CATINDIG, C. T. **Landry's Paralysis following Rabies Vaccine. A Case Report.** *J. Philippine Med. Ass.* 1958, Nov., v. 34, No. 11, 677–8.

A case occurring after the 10th injection.

GAVRILĂ, I., IURAŞOG, G. & LUCA, E. Despre seroprofilaxia antirabică. [**On Antirabic Serum Prophylaxis**] *Microbiol., Parazitol. si Epidemiol.* Bucharest. 1958, Sept.–Oct., v. 3, No. 5, 405–9.

The English summary appended to the paper is as follows:—

"Babes was the first scientist who, as early as in 1888, advocated the association of immune serum in antirabic vaccination. After a long time during which this method was forgotten, it has recently been taken up again and investigated experimentally in this as well as in other countries.

"This report concerns 11 cases of deep bites by the same rabid wolf, among which 4 cases especially, presented extremely deep bites in the head and other areas situated in the proximity of the nervous system.

"In all these cases, intramuscular injections of hyperimmune antirabic serum were associated, at the rate of 3 ml/kgm of body weight, with the injections of vaccine. Serum infiltrations in amounts of 20 ml were also made around the wounds. Up to the present all these cases are safe, as 12 months have elapsed since the bite. On the basis of these favourable results, the authors suggest antirabic serum to be associated with the injections of antirabic vaccine in all cases of wolf bite as well as in severe bites by other animals."

VOLOVICH, N. I., GORDIENKO, E. G., KATS, F. M., KURILOVA, M. A. & KHAIKINA, A. S. **The Experimental Production and Study of Crude and Purified Combined Rabies and Tetanus Antisera.** *Problems of Virology.* London. 1958, v. 3, No. 1, 20–25, 1 fig. [10 refs.] [Translated from Russian.]

"(1) As a result of combined immunization of horses with fixed rabies virus and tetanus toxoid, immune sera were obtained containing considerable titres of antibodies to rabies and tetanus.

"(2) The combined antisera, and especially γ-globulin prepared from them, showed marked protective power when given to animals shortly after infection with fixed rabies virus.

"(3) The results obtained show that a study of the use of combined sera in the prevention of rabies and tetanus holds promise of success."

SELIMOV, M. A., KOVALEVSKII, M. F. & SEMENOVA, E. V. **Anti-Rabies γ-Globulin. II. Study of the Effectiveness of Anti-Rabies γ-Globulin in Experiments on Animals.** *J. Microbiol., Epidemiol. & Immunobiol.* London. 1957, v. 28, Nos. 9/10, 1252–9. [14 refs.] [Translated from Russian.]

The gamma globulin used was prepared at the Mechnikov Institute, Moscow: it was prepared from horse serum with a log. protective titre of 3·4. Given intramuscularly to mice 5 and 7 days before fixed virus intracerebrally its protective effect was poor; but given 48 hours before infection it protected against 1000 LD50. When the protective effect of serum was compared in mice with a course of vaccine by intracerebral challenge with fixed virus the protection conferred by the gamma globulin was as good as that by the vaccines. An experiment in which mice that had received gamma globulin were challenged at intervals after with street virus (from dog brain) showed that immunity lasted for longer than 9 days and had some effect up to 2 weeks. Post-infection treatment of intracerebrally inoculated mice (fixed virus) gave protection in 38 of 40 mice while 23 of 40 control mice died. In mice, guinea-pigs, and puppies, gamma globulin was given within 2 hours of street virus intramuscularly: in mice 95 of 120 were protected compared with 100% deaths in the 120 controls; in guineapigs 5 of 8 were protected compared with none of 5; in puppies 6 of 7 were protected compared with 6 deaths in 7 controls. Gamma globulin was found to be effective if administered up to 48 hours after infection.

In an experiment to compare globulin with globulin + vaccine it was found that in mice post-infection treatment of street virus infections with vaccine

was ineffective and that vaccine did not increase the protection conferred by gamma globulin; in guineapigs vaccine alone was slightly less effective than gamma globulin but the protective power of the latter was not increased by a follow-up course of vaccine; in dogs the numbers were too small for conclusions, only 3 of 5 controls dying; none of the dogs given vaccine or serum, or both, succumbed. *C. E. Gordon Smith*

PLAGUE

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, rodent hosts, transmission, pathology, diagnosis, clinical findings, treatment, control.

BRYGOO, E. R.; GONON, M.; RAKOTOMIHAMINA, S.; RAZAFIMANDIMBY, C.; RAJENISON, S. L'epidemie de peste pulmonaire de Doany en octobre 1957. Epidémiologie. [**The Plague Epidemic in Doany, Madagascar in October 1957. Epidemiology**] [BRYGOO & GONON]. *Arch. Inst. Pasteur de Madagascar*. 1957, v. 26, 124–34, 1 map & 1 chart. Therapeutique et prophylaxie. [**Treatment and Prophylaxis**] [GONON, RAKOTOMIHAMINA & RAZAFIMANDIMBY]. *Ibid.*, 134–8. Diagnostic et laboratoire. [**Diagnosis and Laboratory Investigation**] [BRYGOO & RAJENISON]. *Ibid.*, 138–42. [14 refs.]

i. This paper discusses the epidemiology of an epidemic of pneumonic plague in the isolated and previously unaffected district of Doany in the northern foothills of the high central plateau of Madagascar [this *Bulletin*, 1958, v. 55, 1105]. Plague was introduced by a man from Bealanana where the disease had existed since 1948 [*ibid.*, 1956, v. 53, 1336]. He died and his uncle and his mother who were contacts died of plague within 6 days. These cases initiated an epidemic which was only reported to the authorities after a delay of a month when control was started. There were 36 deaths (one bubonic and 35 pneumonic), 6 patients with pneumonic plague recovered after treatment, 5 suspected cases also were treated and 103 contacts received chemoprophylaxis.

This was the most serious epidemic in Madagascar since 1945. Some interesting features were: its spread in families, since 4 of the 5 families affected were related; its prevalence among those tending the sick; its spread along routes of transport of the sick or dead. Previous workers there have stated that epidemic pneumonic plague rarely occurs when the minimum temperature exceeds 14°C. during the 8 days preceding the notification of deaths. This critical temperature was reached in the present outbreak.

ii. Contacts were isolated and treated for 6 days with sulphathiazole 6 gm. daily, increased to 8 days when the risk of infection was high. About 50 contacts were isolated in their villages, were given prophylaxis, and visited twice daily. In all, 103 contacts were treated; none became infected and there was no intolerance of the drug. 6 contacts were given streptomycin because of clinical conditions suggesting plague, and 3 further suspects also among the contacts; all recovered rapidly. Of 6 patients with pneumonic plague 5 were confirmed bacteriologically. The treatment regime was 0·5 gm. streptomycin intramuscularly every 3 hours for the first 2 days; the sputum was examined

every 3 hours. On the third and fourth days 0·5 gm. streptomycin was given every 4 hours and on the fifth to ninth days every 6 hours. Doses of vitamin B were also given.

iii. This epidemic gave an opportunity of testing a mobile laboratory in which mouse inoculations [*ibid.*, 1957, v. 54, 165] and cultures could be made. Mice were inoculated with sputum treated with penicillin which appears to protect them against pneumococci, and *P. pestis* was recovered in 7 inoculations, 5 times before treatment and twice 6 hours after the start of treatment. Pure cultures of *P. pestis* were obtained in 3 of 5 cultures at ambient temperature in 3 different media. Identifications were confirmed by the use of plague bacteriophage. Direct examination of sputum showed that plague organisms disappeared in 6 to 18 hours after treatment, though in some cases suspicious organisms persisted until 36 hours. Examination of 27 *Rattus rattus* revealed neither fleas (insecticide powder had been used) nor infection.

T. H. Davey

MACCHIAVELLO, A. Estudios sobre peste selvática en América del Sur. III. Peste selvática en la cordillera de Huancabamba, Perú. [**Studies of Silvatic Plague in South America. III. Silvatic Plague in the Huancabamba Mountain Area, Peru**] *Bol. Oficina Sanitaria Panamericana.* 1958, June, v. 44, No. 6, 484–512, 2 maps & 2 figs. [20 refs.]

The author has already reported on studies in 1946 of silvatic (wild-rodent) plague on the Peruvian-Ecuador border [this *Bulletin,* 1958, v. 55, 33] and now writes on investigations of epizootic and epidemic outbreaks of the disease in 1946–47 in northern Peru near the Ecuador border. The region investigated comprised the Huancabamba mountains where an agricultural people were first infected with plague in 1920 (Huancabamba province) and 1922 (Ayabaca province). These initial cases are believed to have been caused by infective *Xenopsylla cheopis* brought up in clothing and goods, etc., transported from the coastal district of Piura where human cases of plague occurred from 1918 to 1923. The two separate foci of silvatic plague which then developed—in the Huancabamba province and in the Ayabaca province—extended until they became one and the whole hill region became by 1939 a single enzootic area.

In 1946–47, the rodent disease became epizootic and the incidence of human cases rose in 1946 and 1947, morbidity and mortality rates being some 600–700 and 300–350 per 100,000 inhabitants. In general, the mortality was greatest in children under 15 and persons over 60 years of age. It is noted that, before the epidemic when enzootic, then epizootic, conditions prevailed (1939–45) in the wild rodents, human cases were commoner in men than in women. During the epidemic, more women, children and elderly people were infected. This is related to the men being infected first when at work in the fields. During the epidemic phase the epizootic in cricetomine rodents had burnt itself out in the fields, but had become severe in the cricetomines which lived close to and in the human dwellings and premises. Women, children and elderly people then were exposed to transmission more than formerly. The rodent most implicated appeared to be *Akodon mollis orophilus,* which was very susceptible to plague, and not only occurred in the fields but entered and nested in the houses and grain stores. *Pleochaetis dolens quitanus* and *Polygenis litargus,* particularly the former, were considered to be the vectors, feeding on and infecting man

outdoors or indoors on the death of the rodents during the epizootic. *Rattus* and *X. cheopis* did not occur in these rural conditions in this mountainous region. Other factors influencing the epizootic and epidemic are discussed. These include the peri-domestic cricetids, *Oryzomys* spp. and pet guineapigs (which were hidden from health inspectors) as further rodent hosts for the infection in and around dwellings. *Sylvilagus* is thought possibly, with the flea *Hoplopsyllus,* to play a part in the enzootic cycle, but the persistence of this cycle is not understood. There is a discussion of this problem which implicates migrations of susceptible rodent species into an enzootic zone as the genesis of an epizootic; rodent numbers may also increase in an area, simply by conditions favouring breeding.

The epidemic of 1946–47 was checked by use of DDT in premises. Wild-rodent plague has extended northwards since the years of the epidemic in Ayabaca, but by 1954–55 the epizootic had reverted to a silent enzootic state; up to 1956 a few cases of human plague still occurred.

There are numerous tables on incidence of the human cases in different areas and places over the years, on sex and age incidence, and concerning the numerous flea parasites obtained on the wild animals and in their nests. The text includes a good deal of clinical matter about the cases. *D. S. Bertram*

JANSSEN, W. A., FUKUI, G. M. & SURGALLA, M. J. **A Study of the Fate of *Pasteurella pestis* following Intracardial Injection into Guinea Pigs.** *J. Infect. Dis.* 1958, Sept.–Oct., v. 103, No. 2, 183–7, 2 figs. [22 refs.]

The object of the enquiry was to determine the fate of virulent *Pasteurella pestis* after its introduction into the circulatory system of the guineapig.

Virulent *P. pestis* when grown *in vivo* was extremely resistant to phagocytosis by neutrophils and macrophages *in vitro* when compared with the same strain grown in heart infusion broth at 26°C. [this *Bulletin,* 1957, v. 54, 816].

When organisms either resistant or susceptible to phagocytosis were introduced into the circulating blood of a guineapig most were removed within 30 minutes to 1 hour, during which period there was an increase in the number of viable organisms in the liver and spleen while the number in the lungs and kidney decreased rapidly. There was little or no evidence of phagocytosis of the organisms by circulating leucocytes after injection of phagocyte-susceptible strains. It is therefore suggested that the fixed macrophages of the reticulo-endothelial system were responsible for their fixation in the liver and spleen where RE cells are plentiful in the blood sinuses, while few were retained in the lungs and kidneys where few RE cells are in contact with the circulating blood. Since strains that are susceptible and those resistant to phagocytosis are removed equally well it is suggested that the RE cells are unaffected by the factors which render virulent organisms resistant to phagocytosis by circulating leucocytes.

After the initial phase of blood clearance the number of the resistant type began to rise in the blood and organs and continued to increase until death 12 to 24 hours later. During the same period the susceptible type steadily decreased in the spleen, liver and lungs until the twelfth hour after inoculation when these too began a steady increase until death 12 to 24 hours later.

P. A. Clearkin

LESHKOVICH, L. I. **The Action of X-Rays on the Virulence and Antigenic Properties of** *Pasteurella pestis*. *J. Microbiol., Epidemiol. & Immunobiol.* London. 1958, v. 29, Nos. 1/2, 199–204. [Translated from Russian.]

"(1) Forty-three days after their first exposure to X-rays 6 out of 9 virulent strains of *P. pestis* lost their virulence for mice in a dose of 100,000 organisms; after 9 months a dose of 20,000 million of 7 of the strains was required to cause death in guinea-pigs.

"(2) The virulence of strain No. 100 was tested in guinea-pigs 1 month after its third exposure to radiation; one-half of the experimental animals survived a dose of 1500 million organisms which indicates that the virulence of other strains may be reduced earlier.

"(3) The vaccine strain EV was subjected to radiation under the same conditions as the virulent strains; this treatment did not reduce its antigenicity, which proves that X-rays have no destructive effect."

SMIT, F. G. A. M. **A Preliminary Note on the Occurrence of** *Pulex irritans* **L. and** *Pulex simulans* **Baker in North America.** *J. Parasitology*. 1958, Oct., v. 44, No. 5, 523–6, 2 figs.

Pulex simulans, first described in 1895, is a flea with a distribution ranging from north-western U.S.A. through Central America to northern South America and occurs on a wide variety of animals (prairie dogs; *Cynomys,* primarily; but also skunk, ground squirrel, opossum, grey fox, coyote and deer). It appears to have been accepted for about the past 40 years as *Pulex irritans,* but this paper advocates the reality of *P. simulans* as a specific entity. The earlier descriptions and views are discussed in this light, and a revised description given which emphasizes differences between the two species. These are most marked in the males and involve details of genitalia (figured for both species) besides other features. *P. simulans* is rather smaller than *P. irritans* in both sexes. The importance of reliable taxonomic identification of the two species in connexion with plague transmission studies is emphasized; some work in this field in the U.S.A. in the past must be presumed to involve confusion from lack of accurate identification of the fleas used. It is requested that authors who have recorded *Pulex irritans* from North America should re-examine their material and publish a note stating whether or not *P. simulans* was, in fact, the species in question. *D. S. Bertram*

MATILLA GOMEZ, V. & PIEDROLA GIL, G. Desratización por el empleo de anticoagulantes sanguíneos sintéticos. [**Rat Control with the Use of Synthetic Anticoagulants**] *Med. Trop.* Madrid. 1958, May–June, v. 31, Nos. 5/6, 389–425; Oct., v. 32, No. 4, 241–81, 16 figs. [4 (2 coloured) on 2 pls.] [Numerous refs.]

AMOEBIASIS AND INTESTINAL PROTOZOAL INFECTIONS

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, pathology, diagnosis, clinical findings, treatment, control.

DÍAZ MARÍN, J. Algunos aspectos parasitológicos en la *Entamoeba histolytica*. [**Parasitological Aspects of Amoebiasis**] *Med. Trop.* Madrid. 1958, July–Aug., v. 32, Nos. 1/2, 7–28. [17 refs.]

In view of the frequent occurrence of amoebiasis in Spanish Morocco, the author gives a general account of the morphology, life cycle and host-parasite relations of *Entamoeba histolytica*, as well as of the various methods used in the diagnosis of amoebiasis, based on literary data and his own observations.

The only original data in this paper concern the incidence of amoebic infections in 1,080 normal persons of the northern part of Spanish Morocco. During the 4 quarters of 1954 the stools of 360, 220, 300 and 200 persons were examined, and *E. histolytica* was detected in 5, 5, 57 and 4 cases respectively.

C. A. Hoare

BASNUEVO, J. G. Caracteres epidemiologicos de la amibiasis en Cuba. [**Epidemiological Features of Amoebiasis in Cuba**] *Rev. Kuba Med. Trop. y Parasit.* 1958, Jan.–June, v. 14, Nos. 1/6, 10–30, 23 figs. [48 refs.] English summary.

The author notes that 25 years ago the incidence of clinical amoebiasis in Cuba had assumed alarming proportions. However, in recent years, thanks to advances in treatment and better sanitation, amoebiasis, though still prevalent, does not constitute a serious problem.

In the present paper are brought together the results of 310,698 faecal examinations, carried out by a number of workers in different towns and provinces of Cuba. Of the total number 5% were positive for *Entamoeba histolytica,* the percentage in seven provinces varying from 2 to 21, though in some groups of the population up to 29% were infected. Although amoebiasis was more common among adults between the ages of 25 and 60, acute forms of the disease—including dysentery—were more frequently encountered in children. On the other hand, amoebic liver abscesses were more prevalent in adults, especially in males.

Both intestinal and hepatic amoebiasis are more common among the white population than among the coloured people, while manual and agricultural workers have a higher incidence than other classes of the population. The incidence of the disease is highest in small villages using well water, which is liable to contamination from open latrines, both of which are usually situated in the backyards. Among the most important sources of infection in Cuba the author mentions contaminated water, vegetables, and carriers handling food, as well as house-flies.

The drug of choice for the treatment of amoebiasis in Cuba is chloroquine.

C. A. Hoare

SWELLENGREBEL, N. H. & RIJPSTRA, A. C. Het commensalisme van *Entamoeba dysenteriae*. [**The Commensalism of** *Entamoeba histolytica*] *Nederl. Tijdschr. v. Geneesk.* 1958, Oct. 18, v. 102, No. 42, 2052–7, 16 figs.

In a short account of the host-parasite relations and epidemiology of amoebiasis, the authors lay emphasis on the fact that *Entamoeba histolytica* may live in the human intestine as a commensal, but—unlike the non-pathogenic amoebae—it is capable of overcoming the host's resistance with the production of clinical manifestations, including amoebic dysentery. This property of *E. histolytica* is described as "commensal infection". It is pointed out that *E. histolytica* has a cosmopolitan distribution, but the incidence of symptomless and clinical infection is much higher in the tropics than in the temperate zone. However, in countries with a cold climate (*e.g.*, Holland) cases of so-called endemic amoebiasis appear to be of exotic origin (*e.g.*, imported from Indonesia). It is therefore thought that the amoebae in the temperate and tropical zones are not identical. The parasite in the latter is more virulent, and capable of overcoming the resistance of symptomless carriers under the influence of climatic, nutritional and bacterial factors.

The health authorities should bear in mind the possibility that exotic strains of *E. histolytica,* when introduced into countries with a temperate climate, might serve as sources of amoebiasis. It is therefore important to identify *E. histolytica* and differentiate it from other intestinal parasites. With this end in view, the authors have devoted the greater part of this paper to short illustrated descriptions of the morphology of the human intestinal protozoa.

C. A. Hoare

BUONOMINI, G., RICCIARDI, M. L. & GOZZI, E. Sulla resistenza delle cisti di *E. histolytica* in varie condizioni ambientali. Nota I. Durata della contaminazione di piantine di insalata (*Lactuca sativa*). [**The Resistance of Cysts of** *E. histolytica* **to Environmental Conditions. Note I. Duration of the Contamination on Lettuce**] *Giorn. di Malattie Infettive e Parassit.* 1958, Sept., v. 10, No. 9, 801–3. [10 refs.]

In order to ascertain whether lettuce contaminated with cysts of *Entamoeba histolytica* might be a source of human infection, the authors carried out experiments on the length of survival of the cysts on these plants. Having first determined that both in cultures and in faeces the cysts remained viable up to 25 days at +5°C., they sprinkled growing lettuce plants with cultures containing cysts, and tested their viability in fragments of lettuce which were removed from the plant at various periods of time and cultivated in diphasic medium at 37°C. Growth of amoebae in culture was obtained up to 25 days after contamination, showing that lettuce, as well as other vegetables consumed in the raw state, might be dangerous vehicles for the transmission of amoebiasis.

C. A. Hoare

BUONOMINI, G. & RICCIARDI, M. L. Sulla resistenza dei trofozoiti di *E. histolytica* in varie condizioni ambientali. [**Resistance of Trophozoites of** *Entamoeba histolytica* **under different Environmental Conditions**] *Giorn. di Malattie Infettive e Parassit.* 1958, Sept., v. 10, No. 9, 804–6. [17 refs.]

In view of the reported transmission of *Entamoeba histolytica* through ingestion of the trophozoites [this *Bulletin*, 1939, v. 36, 290], the authors carried out experiments on the viability of the amoebae in tap water, milk, vegetable

and beef broths, as well as in normal faecal suspensions and urine. For this purpose 48-hour cultures were mixed with these substances, and the mixtures were kept at temperatures of 5°C. and 20–23°C. The results were assessed at various intervals up to 24 hours, by microscopical examination of samples taken from these mixtures and by their cultivation. It was found that the trophozoites survived at both 5° and 23°C. for periods exceeding 24 hours.

It is concluded that drinking water, milk and soups, contaminated with trophozoites of *E. histolytica,* might be sources of human infection.

C. A. Hoare

De Carneri, I. Studi sulla virulenza di *Entamoeba histolytica.* Riacquisto della virulenza verso il ratto albino da parte di due ceppi di *Entamoeba histolytica* dopo lunghi periodi di apparente apatogenicità. [**Studies on the Virulence of *Entamoeba histolytica.* Restoration of Virulence to Rat of Two Strains after apparent Loss of Pathogenicity**] *Giorn. di Malattie Infettive e Parassit.* 1958, Sept., v. 10, No. 9, 798–801. [33 refs.]

The author describes studies on fluctuations in the virulence of 2 strains of *Entamoeba histolytica* after prolonged cultivation. The results were assessed by intracaecal inoculation of young rats. One strain (F22), isolated in U.S.A. in 1948 from an amoebic abscess of the brain, had completely lost its virulence by 1957, but after 9 serial passages through the livers of hamsters its virulence was fully restored, and it infected 100% of the rats inoculated with cultures, producing lesions in 73% of these animals. Another strain (MEAH), isolated at the end of 1955 from cysts of a patient in Liverpool [this *Bulletin,* 1958, v. 55, 1112], was still pathogenic to rats till the end of 1956, after which its virulence suddenly diminished and finally disappeared. However, it was restored after 13 passages through hamster livers, but diminished again after cultivation. " Single-cell " cultures of the attenuated clone showed a moderate pathogenicity for rats, but its virulence was again fully restored after passages through the livers of hamsters.

The foregoing experiments were carried out in the hope of obtaining avirulent strains of *E. histolytica* by prolonged cultivation of pathogenic strains, but the results have shown that the virulence of this amoeba is extremely elastic and can be restored after attenuation following prolonged cultivation.

C. A. Hoare

Salas, M. Anatomía patológica de la amibiasis en los niños. [**Pathological Anatomy of Amoebiasis in Children**] *Gac. Méd. de México.* 1958, June, v. 88, No. 6, 373–83, 6 figs.

It is often stated that amoebiasis is infrequently found in children—a point of view based on the number of cases of clinical amoebic dysentery. Most authorities express the opinion that extra-intestinal complications are also less frequent than in adults. This, however, in the author's experience is not the case. From a study of the pathological material in the Children's Hospital of Mexico it appears that ulceration of the intestines and abscesses of the liver have received special attention, and histological studies of this material have been carried out especially in cases of intestinal perforation and hepatic abscess.

Statistics show that out of 75,922 admissions (1949–57) there were 951 necropsies of which 41 were diagnosed as amoebiasis:

Age incidence	*Necropsies*	*Amoebiasis*	*Abscess of liver*
0–1	420	8	4
1–2	153	15	5
2–3	84	9	3
3–4	49	3	1
4–5	41	2	1
5–6	29	2	0
6–7	28	2	1
7–8	28	0	0

and so on up to the age of 15 when no other cases of amoebiasis were diagnosed.

In addition to the tissues already mentioned, lymph glands, peritoneal exudate, pleural and pericardial effusions were studied, and associated bacteria investigated. The statistics further showed that the incidence of fatal amoebiasis was higher in female children than in males, in the proportion 65·8: 34·2%. In most cases, intestinal lesions, corresponding to the point of entry, were present: lesions of the appendix, diaphragm, lung or pericardium were less common.

The age incidence of liver abscess was as follows:

0–1	4
1–2	5
2–3	3
3–4	1
4–5	1
5–6	0
6–7	1
	15

and again the incidence in females was twice that of males. The distribution of lesions is given in the following list: ulceration of the colon, 39 cases; perforation and peritonitis, 30; hepatic abscess, 15; appendicitis, 9; diaphragmitis, 3; pleuropneumonitis, 3; pericarditis, 2. Perforation occurred in anatomical distribution as follows: caecum, 14 cases; ileocaecal appendix, 9; ascending colon, 12; transverse colon, 7; descending colon, 3; sigmoid colon, 9; rectum, 2; pyloric antrum 1 (rupture of hepatic abscess into the stomach). In 3 cases the hepatic abscess opened through the right diaphragm into the lung: in 2 into the pericardium. Hepatic abscesses were multiple in 12 out of 15: solitary in 3; both lobes were affected in 6; 8 were in the right lobe, and in that situation as well as in Spiegel's lobe in one. In 7 cases the pus was contaminated with associated bacteria. Abscess of the liver co-existed with ulcers of the colon in 13 out of 15, while in the remainder no intestinal lesions could be demonstrated. Typical chocolate pus was usually present even with bacterial contamination with *Klebsiella pneumoniae, Escherichia coli* and *Proteus morgani*. Amoebic appendicitis is relatively common: in autopsies it was found in 9 (21·9%). Pericarditis, a rare complication, was found twice.

Intussusception, which was ileocolic, was found in 5 cases: in one part of the invaginated intestine projected from the anus.

This paper is illustrated with admirable photomicrographs of amoebae in the submucosa, as well as in the muscular coats of the intestine, in the sinusoids of the liver and even invading the muscular fibres of the diaphragm.

Philip Manson-Bahr

KONAR, N. R. & BHATTACHARYA, D. K. **Diallyl-Diethylaminocresol Dihydrochloride in the Treatment of Amoebiasis (Acute and Chronic).** *J. Indian Med. Ass.* 1958, Nov. 1, v. 31, No. 9, 353–5.

"Ten cases of chronic amoebic dysentery, 23 of acute amoebic dysentery, one of amoebic hepatitis and another of amoebic liver abscess were treated with camoform.

"The drug was found to be effective in acute amoebic dysentery. In chronic amoebiasis the result of treatment was not satisfactory.

"The cases of acute amoebic hepatitis and liver abscess with low general condition improved remarkably well. Only camoform was used as the specific therapy in those cases.

"No toxic manifestations were seen, even in patients having cardiac or gastric disorders."

[See this *Bulletin,* 1958, v. 55, 44.]

DAS, N. **Treatment of Chronic Amoebiasis with New Synthetic Compounds.** *J. Indian Med. Ass.* 1958, Nov. 1, v. 31, No. 9, 355–6.

The author, in Calcutta, treated 43 patients having proved *Entamoeba histolytica* infections with Ciba 11925 [this *Bulletin,* 1959, v. 56, 163] and 32 similar patients with 11925C [*loc. cit.*]. The patients were aged 3 to 50 years.

The drugs were given orally in doses of 2 tablets thrice daily, except in children below 8 years who received ½ to 1 tablet thrice daily. Each tablet of 11925 = 100 mgm. and each tablet of 11925C = 50 mgm. The course of treatment lasted 10 days. No abnormalities were found in sigmoidoscopic examinations of 37 patients.

With preparation 11925, 10 patients relapsed after having previously negative stools, but a second course gave "good results". One patient showed no improvement and remained parasitologically positive. 3 patients defaulted. 5 patients had side-effects, usually gastro-intestinal and mostly mild, except in one case where the patient had marked vomiting: he was changed to 11925C, with good results. In all the other cases there was clinical improvement and the stools were negative.

With 11925C there was definite clinical improvement and stools were negative "in almost all these cases" and there was no relapse. 8 patients had side-effects similar to those above, 1 had a tarry stool and treatment was discontinued, and 1 defaulted.

The author concludes that there was little to choose between the 2 preparations. Gastric intolerance might have been due to the use of tablets and it is suggested that this may be obviated by supplying the drugs in capsule form.

H. J. O'D. Burke-Gaffney

WILMOT, A. J., POWELL, S. J. & ELSDON-DEW, R. **Erythromycin in Amebic Liver Abscess.** *Amer. J. Trop. Med. & Hyg.* 1958, Nov., v. 7, No. 6, 656–7.

"Erythromycin, 500 mg, was given every 6 hours for 10 days to six patients suffering from amebic liver abscess.

"Two cases apparently responded, the remainder either failed to respond or relapsed.

"By comparison with emetine and chloroquine, erythromycin is ineffective in amebic liver abscess."

[See this *Bulletin,* 1956, v. 53, 56, 57.]

RAO, K. V. & LYNCH, J. E. **PA 128, a New Antiprotozoal Antibiotic.** *Antibiotics & Chemotherapy.* New York. 1958, Sept., v. 8, No. 9, 437–40, 2 figs.

These authors from the Pfizer Therapeutic Institute, Maywood, N.J., describe the isolation from an unidentified *Streptomyces* of a substance with no activity against bacteria, but inhibiting the growth *in vitro* of *Trichomonas vaginalis* and *Entamoeba histolytica* in concentrations of 0·03 and 0·09 μgm./ml. respectively. Attempts to treat experimental infection by these 2 organisms only showed that the substance is highly toxic: rats inoculated with *E. histolytica* were given it orally, and even a dose of 3·12 mgm./kgm. is said to have been toxic [no details given]: this dose appears to have been tolerated in mice infected subcutaneously with *T. vaginalis* and treated by an unspecified route, but twice the dose killed 3 out of 10 mice. PA 128 is therefore therapeutically useless, but "its highly specialized and unique activity should be of interest in the study of the metabolism of certain species of protozoa".

L. P. Garrod

MARINO, A., ROBERTACCIO, A., BIANCHI, A. & MIELE, E. Rilievi elettrocardiografici nella cavia in corso di trattamento emetinico cronico. [**Electrocardiographic Findings in Guineapigs during Chronic Administration of Emetine**] *Acta Med. Italica.* 1958, Apr., v. 13, No. 4, 85–98, 5 figs. [26 refs.]

LEPROSY

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, pathology, diagnosis, clinical findings, treatment, control.

HERMANS, E. H. Enkele aspecten van het lepra-vraagstuk. [**Some Aspects of Leprosy**] *Acta Leidensia (Scholae Med. Tropicae).* 1958, v. 28, 57–75. [47 refs.] English summary. [Also in *Arch. Belges Dermat. et Syph.* 1957, v. 12, 438–60.]

A survey of present problems.

WORSFOLD, J. T. **The Leprosy Endemic in Northern Rhodesia with special reference to Sex Incidence.** *Leprosy Review.* 1958, Oct., v. 29, No. 4, 222–6. [18 refs.]

The author's intensive survey of the Balovale District of Northern Rhodesia gives a leprosy incidence of 11·85 per 1,000 which roughly corresponds with the results for Northern Rhodesia of previous more extensive surveys [see, for example, this *Bulletin,* 1951, v. 48, 643]. The familial source of infection is shown by 66·25% of all patients having a near relative with the disease. Special emphasis is laid on the sex incidence. While in most countries the preponderance is among males, the numbers at the Chitokoloki Leprosarium were 1,745 males to 2,281 females, a sex rate of 43·3. The author discusses the possible reasons for this, and suggests that the emancipation of women in this district and their growing freedom may have caused a temporary increase in leprosy which may be preliminary to a general diminution in the disease. He does not think that it is dependent on any inherent quality in the women themselves. *Ernest Muir*

DE GONZÁLEZ, Amélia A., MEZA, Desidério, SANTILLAN, Guillermina, RAMOS, Júlia R. & ALVARENGA, A. E. Pesquisas de casos de lepra em Assunção. [**Examination of Leprosy Cases in Asunción**] *Rev. Brasileira Leprologia.* S. Paulo. 1958, Jan.–Mar., v. 26, No. 1, 27–31.

A survey of Asunción, the capital of Paraguay, showed among a population of 248,955 a 3 per 1,000 incidence of leprosy. The rate increased with age. The types were: tuberculoid 39·63%, indeterminate 29·98%, lepromatous 28·3% ; there were 8 pre-lepromatous cases. During the survey 381 patients were enrolled. Compulsory segregation has been abolished and the patients are treated at out-patient dispensaries and given intensive treatment with sulphones. *Ernest Muir*

PRICE, E. W. **The Innervation of the Hand in relation to Leprosy.** *Leprosy Review.* 1958, Oct., v. 29, No. 4, 215–21, 3 figs. [11 refs.]

It is shown that while in 80% of the muscles of hands the innervation is according to standard, in 20% the innervation is anomalous. This anomaly is due to shunting of nerve bundles from one main nerve to another. Weakness of a muscle may indicate a lesion of the normal nerve supply, a lesion of a nerve which gives an anomalous supply, or a lesion of a nerve bundle of the normal nerve which has become involved in the lesion of a second nerve along which it is being shunted. The normal and anomalous motor innervations of the hand and forearm are described and illustrated with line drawings. Similarly the normal and anomalous sensory innervation of the hand are described. "No studies have been found in the literature correlating motor and sensory innervation of the hand." Where sensation has been lost its restoration may be due to one of two factors or to both: renewed innervation or renewed function of the original nerve, or spread from healthy nerves in the

surrounding skin areas. In the former, function is restored proximally and laterally, in the latter the gain of sensation occurs all round the area simultaneously. *Ernest Muir*

TARABINI C., G. & TERENCIO, J. Consideraciones patogénicas acerca de los momentos de origen de la enfermedad de Hansen. [**Pathogenic Considerations regarding the Origin of Leprosy**] *Rev. "Fontilles"*. Alicante. 1958, Jan.–June, v. 4, No. 5, 345–53. [12 refs.] English summary.

The authors propound a hypothesis regarding the determining factors in the onset of leprosy. They give the history of the onset of leprosy in 25 patients, showing that this onset was connected with various circumstances of stress such as the death of a spouse, grave economic difficulties, emotional distress, serious illnesses, childbirth, etc. All these are apt to have an adverse effect on hormonal secretions. Another consideration is the size of the adrenals during early childhood. These glands, according to GOLZIHER, increase in intra-uterine life up to the sixth month when they are larger than the kidneys; after that they diminish and do not regain their former size till the child is 12 years old. The authors suggest that this may account for the greater susceptibility of children to leprosy, and that spontaneous recovery from early leprosy may be connected with increase in size or function of the adrenals.

The authors also refer to the theory already propounded that severe lepra reaction and exacerbations of leprosy are connected with adrenal insufficiency.

On these considerations they found the hypothesis that resistance to leprosy is closely connected with the function of the adrenals. *Ernest Muir*

CONTRERAS, F., GUILLÉN, J., TERENCIO, J. & TARABINI C., G. Pronóstico de las leprorreacciones. [**The Prognosis in Lepra Reaction**] *Rev. "Fontilles"*. Alicante. 1958, Jan.–June, v. 4, No. 5, 317–23. English summary.

After setting out the various opinions in favour of and against the beneficial effects of lepra reaction the authors give their own opinion. They consider that when there is any "stress" on the body an alarm is sounded against the aggressor, whatever it is, and this is accompanied by a discharge of corticotrophin which acts on the adrenals so that they liberate defensive hormones in the first phase. In the second phase, that of resistance, the suprarenal hyperfunction stimulates all the metabolic functions of the economy and repels by its antiphlogistic action the inflammatory condition. When the aggressor is overcome the reaction disappears. In the third phase, that of exhaustion, the organism can no longer resist the aggressor and a state of lepromatization occurs and causes constant infiltrations and ulcerations and new lesions affecting the parenchymas, and leads to fatal amyloidosis and cachexia. The authors therefore divide cases with lepra reaction into 4 groups: according to whether they have had 1 or 2 reactive phases, 3 to 5 reactions, 6 or 7 reactions, and 8 or more reactions. In the years since 1946 the number of patients in the Fontilles institution has increased from 267 to 301, but the number of reactions has decreased from 197 to 99, and the number of deaths from 25 to 8. The diminished deaths are reckoned to be a result of the diminished reactions.

Ernest Muir

YAMAMOTO, T., NISHIURA, M., HARADA, N. & IMAEDA, T. **Electron Microscopy of Ultra-Thin Sections of Lepra Cells and** *Mycobacterium leprae*. *Internat. J. Leprosy*. New Orleans. 1958, Jan.–Mar., v. 26, No. 1, 1–8, 1 text fig. & 13 figs. on 9 pls. [17 refs.]

These studies with *Mycobacterium leprae* were made on specimens from 6 lepromatous patients and they show that the cell wall, which was 6 mμ thick, consisted of outer and inner layers of high electron density and a less dense central layer. There was no distinct cytoplasmic membrane; the cytoplasm was moderately dense and relatively homogenous, but there were terminal condensations resembling the Type A body of *Mycobacterium avium* in the bacilli from well-treated patients. The nuclear apparatus was clearly visible and, in the bacilli from 1 patient, it consisted of moderately electron-dense threads about 9 mμ wide, embedded in an electron-transparent material. As these threads were not visible in the bacilli from well-treated patients, the authors suggest that they are associated with active cell division, especially as the bacilli contained Feulgen-positive granules, indicating that the threads are chromosomes or chromonema.

Single bacilli in " lepra cells " were embedded in the ground substance of the cytoplasm, but sometimes they, as well as small groups of bacilli, were surrounded by a limiting membrane which seemed to be the cell membrane of the cell, deeply indented during phagocytosis. In well-developed cells there were well-circumscribed foamy structures containing many bacilli which were surrounded in 2 of the patients by an electron-dense membrane composed of miscelles, 20 mμ × 3 mμ in size. The bacilli were lying side by side, which is very different from that of *Mycobacterium leprae-murium*.

From these observations the authors suggest that there is no early change in the cytoplasm after phagocytosis but as the bacilli multiply they become surrounded either with electron-transparent zones, which seem to be the gloea, or by some finely granular material of moderate density; this latter material is the opaque droplets which increase and coalesce to form the foamy structure, the lepra cell then becoming rounded with its nucleus pushed aside.

In the authors' opinion the surest indication of viability is the presence of the nuclear apparatus in the bacillary bodies. *S. R. M. Bushby*

SHARMA, K. D. & SHRIVASTAV, J. B. **Lymph Nodes in Leprosy.** *Internat. J. Leprosy*. New Orleans. 1958, Jan.–Mar., v. 26, No. 1, 41–50, 6 figs. on pl. [27 refs.]

This investigation was undertaken with 2 objects: to study structural changes in the lymph nodes in lepromatous leprosy, and to see if they are affected in tuberculoid leprosy. 95 out of 155 patients examined showed enlargement of 1 or more nodes, in most cases this being only slight. In lepromatous patients the cut surface was uniformly yellowish or with yellowish patches. The cut surface in the tuberculoid patients was uniformly pinkish-grey. There was thickening of the capsule in only 25%, and there was no periadenitis. In the lepromatous cases there was the usual appearance with foamy cells and vacuoles. The marginal sinuses were unaffected. Acid-fast bacilli were seen in all but one. None of the 16 nodes in tuberculoid patients showed any significant pathological changes. The authors end by reviewing the literature on the subject. *Ernest Muir*

GOKHALE, B. B., OAK, Usha & WABLE, S. M. **Leprosy and Lung Lesions. A Report on Investigation of Three Cases by a Differentiating Stain: "Sudan Black".** *Leprosy Review.* 1958, Oct., v. 29, No. 4, 204–8, 6 pls. [10 refs.]

The authors describe 4 cases of leprosy, 3 of them tuberculoid and 1 dimorphous, in all of which *Myco. tuberculosis* was demonstrated in the sputum, the Ziehl Neelsen stain, and also the Sudan Black stain as described by Chaussinand and Viette, being used to distinguish from *Myco. leprae.* Radiograms confirmed the diagnosis of pulmonary tuberculosis in 3 patients (Nos. 1, 2 and 4). Culture reports were positive in cases 1 and 3. Laryngoscopy in the first 3 cases showed no abnormality.

The method of staining with Sudan Black is described.

As the presence of leprosy of the lungs is a matter of controversy it is suggested that other workers should report their cases similarly.

Ernest Muir

JUNNARKAR, R. V. **Late Lesions in Leprosy.** *Leprosy in India.* 1957, Oct., v. 29, No. 4, 148–54, 8 figs. on 4 pls. [12 refs.]

In order to throw light on the controversial question of whether or not the lungs are affected by leprosy the author performed autopsies on the bodies of 20 leprosy patients. Ulcerating lesions were found in the upper respiratory tract of the 14 lepromatous cases and in 2 of the tuberculoid cases. In 7 cases there was tuberculosis of the lungs, and there were other lesions in the lungs of 6 others. In one lepromatous case a few clumps of acid-fast bacilli were seen scattered irregularly in the interalveolar septa, either intracellularly or extracellularly, but without any pathological lesion ; cultures of material from the lungs of this case were negative for tubercle bacilli. The condition of the other systems was also investigated and is described.

The sputum from 27 leprosy patients was examined for acid-fast bacilli, smears being examined, cultures made and guineapigs inoculated. When the findings of the bacteriological examinations were compared with the observations of the autopsy material, it was considered that the bacilli detected in the sputum of 23% of patients (excluding 4% with tuberculosis) might either be coming from the ulcers of the upper respiratory tract, or be a manifestation of a generalized bacteriaemia. There was no evidence of leprous lesions of the lungs in the patients examined.

Ernest Muir

HANKS, J. H. **Excitation of Specific Immune Response in Leprosy Patients.** *Internat. J. Leprosy.* New Orleans. 1958, Jan.–Mar., v. 26, No. 1, 9–23. [45 refs.]

The recognition that *Myco. leprae* possesses the one essential quality of an antigen, namely, individuality of specific determinants, encourages re-examination of the impression that it contains antigens less potent than those of *Myco. tuberculosis* and *Myco. leprae-murium.* Examples are given of the *in vitro* enhancement of protection or immune response by injecting antigens suspended in oils or esters. It is suggested that the therapeutic effect of hynocarpus oil,

especially when injected intradermally, may have been partly through stimulating *in vivo* in this way the antigenic property of the bacilli already present in the skin. The adjuvant effect of a suspension of antigen in oil can be still further enhanced by adding non-specific bacteria. The author reviews certain mycobacterial antigens which have been used in leprosy with apparently partial benefit. This benefit applies also to other antigens such as in smallpox vaccination.

In mycobacterial diseases there are two types of response: (A) those due to pre-existing hypersensitivity, and (B) those associated with the generation of new immunological capacity in the form either of antibody production or of altered cellular response.. The B type of response is shown by the growth of plasma cells in lymph nodes in the neighbourhood of the point of injection of the antigen. A second injection in the same place gives a much more rapid production of large amounts of antigen (the second response). "With a given amount of antigen, optimal efficiency results from multiple primary injections which stimulate a greater number of lymph nodes, and from re-stimulation of the same tracts." The Fernandez type of reaction to lepromin antigen is probably of the A type of response, while the Mitsuda reaction is of the B type. "Remote positivization" is also probably of the B type, in which sites where the lepromin injection has at first failed to produce a reaction give a reaction later after a subsequent later injection of BCG. The author suggests as worthy of consideration the use of other mycobacteria as immunizing antigens to leprosy in tuberculin-positive subjects, such as *Myco. butyricum, Myco. marianum,* or *Nocardia asteroides*; even vaccinia or other viral agents might be considered. His last suggestion is the use of wetting agents along with oils and esters which are not as indestructible as mineral oil, but are less wettable, saponifiable and digestible than vegetable oils. *Ernest Muir*

BERGEL, M. Primera lepromina animal con bacilos de Hansen: obtención y estudio comparativo con leprominas humanas. [**First Animal Lepromin with Hansen's Bacillus: its Preparation and Comparative Study along with Human Lepromins**] *Semana Méd.* 1958, Aug. 7, v. 113, No. 6, 271–80, 292, 24 figs. English summary.

The author refers to his previous reports of inoculation of rats on pro-oxidant diet with human leprosy [see this *Bulletin,* 1958, v. 55, 527; 1337]. Then he describes how he took material from the testis of one of the rats in the third reinoculation series. From this material he prepared a lepromin to be compared by intradermal inoculation in 9 human subjects with lepromin prepared from nodules according to the Mitsuda method and the Dharmendra method. In a table he shows that the reactions in these 9 subjects were almost identical, especially in the late or Mitsuda reading. Those on whom the test was carried out were 3 patients with tuberculoid and 2 with lepromatous leprosy and 4 patients with other skin diseases.

As lepromatous patients are unable to react to *Myco. leprae* but react to other mycobacteria when used as the inoculum for the lepromin test, the author concludes that this is the first time that a lepromin containing the bacillus of Hansen has been prepared from an experimental animal.

Ernest Muir

DAVEY, T. F. & DREWETT, S. E. **Lepromin-Like Activity of Normal Skin Tissue.** *Leprosy Review.* 1958, Oct., v. 29, No. 4, 197–203.

Following the work of KOOIJ and GERRITSEN [1957, v. 54, 577; 1958, v. 55, 1019] the authors investigated the reported lepromin-like activity of an antigen prepared from normal human skin. The material was prepared according to Wade's modification of the Mitsuda method. The patients selected were lepromatous 10, indeterminate 3, borderline 10, minor tuberculoid 17, and major tuberculoid 10. For the controls both standard and refined lepromin (Dharmendra's antigen as simplified by Lowe) was prepared. Each of the 50 volunteers was inoculated simultaneously with each of the 3 antigens and with carbol saline as an extra control. Reactions were read after 24 and 48 hours, on the seventh day, and then weekly up to the 35th day. It was found that the normal skin preparation did not induce the Fernandez or early reaction, but that it induced a late Mitsuda reaction in tuberculoid leprosy indistinguishable from that produced by the ordinary antigen smaller in degree, and slightly smaller than that produced by the refined antigen.

It is concluded that when the Mitsuda (late) reaction alone is concerned it is questionable whether the refined lepromin has any advantage over the normal skin preparation. It remains to be seen whether these results are due to contamination with unsuspected antigens such as microfilariae or fungi. Kooij and Gerritsen's findings are at least partly confirmed, but more experiments are required with histological controls of the skin material used. *Ernest Muir*

OLMOS CASTRO, N. & ARCURI, P. B. **Attempts to obtain an Antigen (LPT) suitable for Study of Hypersensitivity in Leprosy.** *Internat. J. Leprosy.* New Orleans. 1958, Jan.–Mar., v. 26, No. 1, 51–6.

This antigen was obtained from fresh lepromas which had been heated for 30 minutes at 100°C. The epidermis and extraneous tissues were removed and the nodules, after being dried in an oven at 56°C., were first ground to a fine powder and then ground with chloroform until no acid-fast bacilli were microscopically detectable. After the chloroform had evaporated, the powder was washed several times in ether by centrifuging. The deposit was then suspended in water in the proportion of 4 gm. of the original dried leproma per litre and centrifuged. The supernatant fluid contained the antigen and it was distributed into 1 ml. quantities, dried at 56°C. and sterilized by dry heat at 120°C. for 30 minutes.

The antigen is named "leprolina proteicea total" (LPT) and is dissolved in 1 ml. of saline and the dose is 0·1 ml.; the result is read as in the early lepromin reaction. The authors have prepared 5 batches and found them to be of similar potency. Failure to sensitize dogs with repeated injections of LPT suggests it is not allergenic.

Among leprosy patients tested, 19 lepromatous patients failed to react whereas 14 of 17 tuberculoid patients reacted in a manner similar to the reactions following the injection of lepromin filtrates or Dharmendra's purified protein. Of 81 supposedly healthy non-contacts, only 4 were positive, but of 91 non-contacts who previously had been given 2 or more injections of integral lepromin, 71 were positive, and of 56 persons supposedly free from leprosy and who had been previously hypersensitized with integral lepromin, 26 showed, on injection of the LPT, reactivation of the lepromin nodules. *S. R. M. Bushby*

BROWN, J. A. K. **A Modification of the Lepromin Test.** *Leprosy Review.* 1958, Oct., v. 29, No. 4, 184–96, 7 figs. on 3 pls.

This paper is divided into 4 parts. In the first there is described a "multipuncture lepromin test" with the Heaf apparatus. The skin is punctured through a 1 in 20 or a 1 in 100 suspension of lepromin (with 10% glycerin added) smeared on the skin. The reaction at the 6 tiny punctures appeared at a different time in each person, varying from 24 hours to 4 weeks, in the 192 non-lepromatous patients tested.

In the second part of the paper this method is correlated with the usual method of lepromin testing. The 3 grades devised according to the severity of the reaction with the multipuncture method, were comparable with 3 grades of positivity when the usual intradermal method was used. In Table I the results with the two methods are compared. "The chief feature of the results is that they broadly corresponded, the larger the infiltration by the intradermal method the more prominent the reaction to the multipuncture tests."

In the third part of the paper simultaneous testing with lepromin and tuberculin by the multipuncture method is described. "An interesting feature was that 15 of the lepromatous patients had a Grade IV response to PPD with blistering and of these 13 had an exaggerated response to the lepromin in which the papules coalesced and there was diffuse infiltration." In 228 patients, two-thirds of the series, the two tests coincided; "The remaining third was divided equally between those that were positive to one and negative to the other, or negative to one and positive to the other". It is considered that the multipuncture test appears to fulfil the criteria of being simple to apply and being without inconvenience to the persons concerned most of whom will be uninfected children in the families of patients.

The fourth part of the paper deals with the use of dilute and "depot" lepromins. More positives were obtained when glycerin was used, and there were stronger results with 1 in 20 than with the 1 in 100 antigen in the multipuncture method. The depot medium tried consisted of 8 parts of light liquid paraffin and 1 part of anhydrous lanolin, to 4 ml. of which 1 ml. of isotonic saline was added. It was found that the response to 1 in 500 depot lepromin was as good as that to 1 in 100 saline lepromin. It is considered that, in using BCG, if even 50% of negative lepromin reactors can be converted to positive a big step forward will have been taken, as there is evidence that those who do convert are, after BCG inoculation, much less likely to contract leprosy and if they do it will be in its less infectious form.

[A matter which requires explanation is the occurrence of a positive lepromin reaction in 11 out of 59 lepromatous cases (18·6%) as shown in Table II.]

Ernest Muir

KOOIJ, R. & RUTGERS, A. W. F. **Leprosy and Tuberculosis. A Comparative Study with the Aid of Skin Tests with Tuberculin, Killed BCG, and the Dharmendra Lepromin in South African Bantus.** *Internat. J. Leprosy.* New Orleans. 1958, Jan.–Mar., v. 26, No. 1, 24–40, 4 figs. [30 refs.]

The object of this study was to test the immunological relationship between leprosy and tuberculosis, and whether tuberculosis protects against leprosy. Five groups were examined: 62 patients with lepromatous leprosy, 54 with

tuberculoid leprosy, 92 healthy leprosy contacts, 101 patients with active tuberculosis, 150 healthy controls. All were of the Bantu race. With the tuberculin test (PPD 5 TU) 82% were positive in the first group, 76% in the second, 89% in the third, 97% in the fourth, and 70% in the fifth. In the lepromin test (with Dharmendra antigen) 50% were positive in the second group, 56% in the third, 44% in the fourth, and 41% in the fifth. In the BCG test, with BCG killed by heat, 85·5% were positive in the first group, 72·2% in the second, 97·6% in the third, 100% in the fourth, and 89% in the fifth. The results indicated that the late reaction to lepromin in some tuberculin-negative healthy people was slightly intensified and accelerated in patients with tuberculosis and tuberculoid leprosy. This might be explained by the non-specific Dienes effect. It is difficult to draw conclusions on the degree of protection by BCG from this study. *Ernest Muir*

TARABINI C., G. & TERENCIO, J. Hemaoaglutinación de Middlebrook-Dubos en la enfermedad de Hansen. [**The Middlebrook-Dubos Haemagglutination Test in Leprosy**] *Rev. "Fontilles"*. Alicante. 1958, Jan.–June, v. 4, No. 5, 325–43. [36 refs.] English summary.

The authors performed this test in 112 patients with the lepromatous, 10 with the tuberculoid and 16 with the indeterminate type of leprosy. In Table I the type, bacteriological and clinical condition of the patient and the serum dilution of each case are given. In Table II increases and diminutions of titres on re-testing are given. In Table III the relationship between haemagglutination and the serum protein levels is given. The results correspond with the findings of previous workers. The test is not of value in the diagnosis of leprosy, but rather in assessing the condition of the patient and the degree of progress toward recovery.

The agglutinins in the serum depend on the bacillary amount and on the patient's humoral antigenic power. Generally the higher rate of agglutinins corresponds with the degree of infiltration and the advance of the disease; also to some extent with the reactive state. The contrast between the results of this test and the lepromin reaction depend on the humoral factor in the first and the histological factor in the second. The relationship between the agglutinin test and electrophoresis results is commented on. *Ernest Muir*

SUSMAN, I. A. **Clinical Observations on Erythema Nodosum Leprosum (E.N.L.).** *Leprosy Review*. 1958, Oct., v. 29, No. 4, 227–31, 4 graphs.

Out of the 328 lepromatous patients at the Ankaful Leprosarium in Ghana 174 suffered from 906 attacks of erythema nodosum leprosum (ENL). The reaction was characterized by cutaneous eruptions, fever and pain. A few of the patients were suffering from complicating diseases such as ankylostomiasis, malaria, etc. In most cases ENL was cyclic with a cycle of 1 to 6 months. It was specially common in those with a high bacteriological index. It was equally frequent whether the patient was on DDS, Sulphetrone [solapsone] or thiacetazone. There was no correlation between the stage of the disease and the occurrence of ENL. In the wet 6 months 52% of attacks occurred, and 48% in the dry 6 months. Stibophen was found to be only a palliative, but

doses of 25 i.u. of corticotrophin intramuscularly gave dramatic improvement, and it was generally not necessary to continue it for more than 3 to 10 days.

Ernest Muir

De Almeida Neto, E. & Revelles, J. P. O emprêgo da D-cycloserina no tratamento de lepra. (Resultados preliminares.) [**The Use of D-cycloserine in the Treatment of Leprosy**] *Rev. Brasileira Leprologia.* S. Paulo. 1958, Apr.–June, v. 26, No. 2, 63–102, 11 figs. English summary.

D-cycloserine (D-4 amino-3 isoxazolidinone) is a derivative of *Streptomyces orchidaceus*. The authors treated 20 lepromatous patients, most of them either untreated advanced cases or else sulphone resistant. The drug was given in 250 mgm. tablets, the maximum dose being 4 to 6 tablets daily. Treatment lasted from 1 to 11 months. In 4 cases sulphones were added to the treatment, and in 1 case thiosemicarbazone was given. The clinical and bacteriological results at the beginning and during treatment, and also the blood, urine and sedimentation examination results are given in 3 tables. Full details of each case are given separately.

In the time under consideration none of the patients became bacteriologically negative, but there was marked improvement, especially in smears taken from the nose. The clinical results were rapid and striking, and are illustrated in a series of photographs.

It is considered that the drug acts directly on *Myco. leprae* and that it acts in a different manner from the sulphones. A combined treatment with cycloserine and sulphones is therefore suggested. As side-effects and serious reactions are uncommon, and as signs of drug resistance have not been encountered, the drug should be especially used in patients intolerant of or failing to respond to sulphones. Trials of longer duration are, however, necessary before a full assessment of the value of cycloserine can be arrived at. *Ernest Muir*

Beckett, D. W. **A Trial of Antigen Marianum as an Adjunct of D.D.S. in the Treatment of Lepromatous Leprosy.** *Leprosy Review.* 1958, Oct., v. 29, No. 4, 209–214.

In this trial 84 lepromatous type patients were treated with "Antigen marianum" in addition to DDS. Treatment lasted for 3 years. Each patient was given 0·1 ml. intradermally once a month for 6 months; three of these six-month courses were given with a six-month interval between. 21 patients on DDS alone were used as controls, these were also lepromatous and had a rather more active form of disease than the 84. At the beginning of the trial 15·5% of the 84 were lepromin positive. At the end of the trial this number had increased to 82·1%. Out of the 84 patients 31% had been discharged, 43% had improved and 26% were stationary or worse. The corresponding figures for the controls were: 19% discharged, 57% improved and 24% no better.

It is concluded therefore that the conversion to positive of the lepromin reaction did not necessarily indicate that the patient had become more resistant to the infection, and that the lepromin conversion did not mean that the type

of disease had become converted from lepromatous to tuberculoid. "It is concluded that antigen marianum was of no value when given as an adjunct to DDS in the treatment of lepromatous leprosy." *Ernest Muir*

CHENEVEAU, R. La lutte contre la lèpre en A.E.F. [**The Campaign against Leprosy in French Equatorial Africa**] *Méd. Afrique Noire.* Dakar. 1958, Dec. 1–15, v. 5, No. 23, 535–8.

Beginning in January 1954, the public health authority mobilized all available agencies under the *Service Général Mobile d'Hygiène et de Prophylaxie.* The method adopted was to make a leprosy survey, place the patients in each region under the care of a doctor, fix the treatment for each patient, determine the methods of administration of treatment allotting patients to hospitals, agricultural colonies, treatment centres, or arranging for domiciliary treatment in the villages. The census showed the numbers of patients and percentage of population according to territories: Middle Congo 11,188 (1·6%), Gabon 7,057 (1·8%), Oubangui-Chari 56,508 (5·1%), Tchad 40,883 (1·6%). The percentages of the different forms of leprosy were lepromatous 6·85, tuberculoid 54·19, indeterminate 38·94.

Two forms of sulphone administration are used: (1) orally with 50 mgm. tablets, the dose being given once weekly and increasing within 5 weeks from 1 to 12 tablets; (2) injections of slow-absorption suspension given twice a month, beginning with 1 cc. (250 mgm. of DDS), and increasing each 15 days by 1 cc. to a maximum of 5 cc. The form of treatment used and the amount of the dose are regulated according to the form of the disease and the state of the patient.

The greatest difficulties in treating these thousands of patients are the different conditions of the disease and the distances that have to be traversed, often through country without suitable roads. Many of the patients are gathered together in villages, and these are preferably situated along the main roads so that they can be easily reached by mobile dispensaries. Motors are used when possible, but often the hospital assistant has to travel by cycle carrying with him necessary light equipment. Motors will often have to traverse a circuit of 1,500 km. twice a month, and cycles a circuit of 150 to 200 km. In other parts it is necessary to travel by horse or ox where motor and cycle cannot pass.

Details of finance are given, including the expense of supplying of 15 motors and 75 bicycles, the recruitment of sanitary assistants and 64 *infirmiers,* the number of which is constantly needing to be increased. Funds, besides those supplied by the Federation, have been received from United Nations and other international funds and from missions and charitable societies.

When the work as a whole is reviewed the results so far accomplished constitute an undeniable success. *Ernest Muir*

MARNEFFE, H. & FOURNIER, J. Le dispensaire antilépreux de l'Institut Pasteur de Saigon. [**The Anti-Leprosy Dispensary at the Saigon Pasteur Institute**] *Rev. Méd. et d'Hyg. d'Outre-Mer.* 1958, Dec. 15, v. 30, No. 273, 148–56.

The history is described of this dispensary, which, beginning in 1931 with 7 patients, gradually increased till it was treating 426 patients in 1939. The

manner of treatment, improvement of buildings, and the results obtained are described in detail. Treatment was interrupted by the war in 1945, but since 1946 the work has increased, especially after the introduction of the sulphones. In 1957 there were 581 new patients, and at the end of that year a total of 5,281 patients had been registered.

The conclusion is strongly in favour of the treatment of leprosy patients in dispensaries, provided the patients are treated with sympathy and with respect for their dignity. *Ernest Muir*

AZULAY, R. D. & NEVES, R. G. Comportamento do teste lepromínico em cobaios becegeizados por via oral. [**Lepromin Tests in Guineapigs given BCG by Mouth**] *Rev. Brasileira Leprologia.* S. Paulo. 1958, Apr.–June, v. 26, No. 2, 103–6, 2 figs. [15 refs.]

The English summary appended to the paper is as follows:—

" 1.ª — BCG was inoculated by mouth in guinea-pigs.

" 2.ª — The inoculated animals were tested intradermically with lepromin antigen.

" 3.ª — The positivity of reaction to lepromin varied according to the dose of BCG.

" 4.ª — The highest percentage of positivity (87·5%) appeared in the group that took 30 mg by Kilogram of weight, that is the same amount of BCG that is commonly given to newborn children in Brazil."

HADLER, W. A. & ZITI, L. M. Ação da hialuronidase testicular sôbre a evolução da lepra murina. [**Effect of Testicular Hyaluronidase on the Development of Murine Leprosy**] *Rev. Brasileira Leprologia.* S. Paulo. 1958, Apr.–June, v. 26, No. 2, 107–9. [12 refs.]

The English summary appended to the paper is as follows:—

"The effect of testicular hyaluronidase on the evolution of murine leprosy was studied in rats, inoculated with *M. lepraemurium* by the intraperitoneal route. The results, which were based on the statistical analysis of the survival time and on the evolution of the leprosy lesions show, that the hyaluronidase administered by the subcutaneous route (dose: 25 U each two days), does not modify the evolutive rate of the disease. This enzyme has neither determined more rapid bacillary dissemination, nor has influenced the leprous lesions or mycobacteria growth rate in the rat tissues. There is no interaction between hyaluronidase and DDS treatment."

HADLER, W. A. & ZITI, L. M. Relação entre a dose de *M. lepraemurium* experimentalmente inoculada e a sobrevivência de ratos tratados e não tratados pela 4-4′ Diaminodifenilsulfona. [**Relation between the Dose of *Myco. leprae-murium* inoculated Experimentally and the Survival Time of Rats Treated and Untreated with DDS**] *Rev. Brasileira Leprologia.* S. Paulo. 1958, Jan.–Mar., v. 26, No. 1, 19–25, 1 fig. English summary.

Three groups of 40 rats each were inoculated intraperitoneally with respectively 5·7 mgm., 2·85 mgm. and 0·57 mgm. of *Myco. leprae-murium* in suspension. Half the rats in each group were treated with DDS and half were not;

the treatment started on the seventh day after inoculation. It was found that sulphone treatment increased the survival time of the animals, and the survival time was independent of the amount of the inoculum of bacilli. The survival time of the untreated animals, however, was longer in inverse proportion to the size of the inoculum. A graph shows that the relation between the survival time of the untreated animals and the logarithm of the bacillary dose is linear, and thus if the survival time is known it is possible by this means to make a biological assay of the inoculum. *Ernest Muir*

HADLER, W. A. & ZITI, L. M. Modo de ação da Dihidroestreptomicina e do 4-4′ Diaminodifenilsulfona na lepra murina. [**Mode of Action of Dihydrostreptomycin and DDS in Rat Leprosy**] *Rev. Brasileira Leprologia.* S. Paulo. 1958, Jan.–Mar., v. 26, No. 1, 33–45, 5 figs. & 1 graph. [16 refs.] English summary.

In this experiment DDS and dihydrostreptomycin were tested for their action on rat leprosy. Two groups of rats were inoculated intraperitoneally with 0·5 ml. of suspension containing 5·7 mgm. of bacilli. The first group contained 4 lots of 20 animals each. One of these lots acted as control, while the others were treated respectively with 40 mgm. daily of DDS, 10 mgm. daily of dihydrostreptomycin intramuscularly, and DDS along with dihydrostreptomycin. Treatment began on the seventh day after inoculation with bacilli.

The second group was the same as the first except that treatment was not begun till the 150th day after inoculation with bacilli.

In the first group all three forms of treatment prolonged survival time, especially the last two, in which the effect became evident on the 60th day of treatment. In those treated with DDS it became evident on the 240th day.

In the second group treatment did not increase survival time, but DDS produced involutive effect on the 90th day, and dihydrostreptomycin on the 250th day.

From these observations it is surmised that the modes of action of DDS and dihydrostreptomycin are different in murine leprosy, the former having a bactericidal effect and the latter a bacteriostatic effect; DDS acts best at the later stages of the disease and dihydrostreptomycin in the earlier stages of the disease. *Ernest Muir*

HANKS, J. H. **The Magnitude of the Immune Response incited by Killed and Attenuated Mycobacteria.** *J. Immunology.* 1958, Oct., v. 81, No. 4, 297–301, 2 figs. [12 refs.]

In this paper the results of some experiments by the author and other workers are discussed [this *Bulletin,* 1957, v. 54, 178; *Bull. Hyg.,* 1955, v. 30, 583]. In the experiments mice had been infected with living BCG or R1Rv1, with or without heat-killed *Mycobacterium leprae-murium,* and challenged later with *Myco. leprae-murium* or virulent tubercle bacilli. Assessment of the immune response is based on the observation that a linear relationship exists between the log. of an infecting dose and the median response, measured for instance by the incubation period or the survival time. For example, in

these experiments with *Myco. leprae-murium*, the lengthening by 1 month of the time in which the lesions become palpable in 50% of the animals is equivalent to decreasing the challenge dose by × 10.

Analysis of the experiments show that immunization with BCG alone or with heat-killed *Myco. leprae-murium*, 63 days before challenge with *Myco. leprae-murium*, extended the median incubation period by × 2 and that the addition of a small quantity (1/14th) of dead *Myco. leprae-murium* to the BCG vaccine extended the time by ×3; these extensions are equivalent to increasing the challenge dose by × 10^5 and × 10^{11}, respectively, and thus indicate a high degree of protection. Specific protection by BCG, *i.e.* against H37Rv, was greater than non-specific protection against *Myco. leprae-murium*, for the median survival time was × 4. The increased protection against *Myco. leprae-murium* afforded by the injection of the small quantity of specific antigen, *i.e. Myco. leprae-murium*, with the BCG, is probably due to the BCG acting as an adjuvant.

In experiments in which the protection is subsiding because of delay in challenging, *e.g.* 7 months, the protection measured by the median incubation period may be the equivalent of only 5–10 challenge doses of *Myco. leprae-murium*, but nevertheless the previous experience of the antigen by the animal modified the end result of the infection, for healing of lesions occurred in some animals, an event which is most unusual in unimmunized animals.

In spite of this high degree of protection afforded by these vaccines the true assessment of the role of such vaccines in chronic mycobacterial infections is impossible because, in the unimmunized animals, immunity from the challenge dose begins to operate before the end-points are reached; there are therefore no unimmunized animals for comparison. A second complicating factor in making these assessments is the overlap that occurs in the responses of animals in the unimmunized and the control groups, due to the differences between individuals being greater than the differences between the groups; assessment must therefore be based on the "average" individual, *i.e.* the 50% response.

In general the problem of giving protection against mycobacteria would not appear to be due to the antigens failing to incite a high immunity response in the "average" person or animal, but rather to the very high protection needed against these particular bacteria and to the difficulty of producing such levels in persons or animals unable to make an "average" response.

S. R. M. Bushby

HADLER, W. A. & ZITI, L. M. **BCG Action upon the Evolutive Rate of the Disease shown by the Golden Hamster** (*Criscetus auratus*) **experimentally infected with** *Mycobacterium lepraemurium*. *Rev. Brasileira Leprologia.* S. Paulo. 1958, Jan.–Mar., v. 26, No. 1, 11–18, 1 fig. [33 refs.]

Experiments in rats have produced equivocal evidence that vaccination with BCG gives some protection against *Mycobacterium leprae-murium*. Hamsters infected with this organism show an initial resistance against the disease, and during this period the lesions show a strong tendency to heal; but later the infection breaks through this resistance, the lesions then develop more rapidly and the animal eventually dies. This change in the course of the disease is regarded by the authors as evidence that the tissues of the hamster react less

stably to the infection than do those of the rat, and the hamster is therefore more suitable than the rat for determining the effects of BCG immunization.

A group of 15 hamsters was injected subcutaneously with 20 mgm. of killed BCG and 22 days later these animals and a second group of 14 unimmunized animals were infected intraperitoneally with 5 mgm. of *Myco. leprae-murium*. 3 of each of the groups were killed and the others were allowed to die of the disease. The first vaccinated animals died on the 48th day and the last in the 183rd, the average survival time being 120 days; the first of the unvaccinated animals died on the 60th day and the last on the 246th day; the average survival time being 150·4 days. When the individual survival times are plotted the 2 lines show a different slope and co-variance analysis reveals that the differences are significant.

The vaccinated animal thus shows a lower survival rate than the control animal by about 25% and the pathology of the lesions confirms that the vaccination has a deleterious effect. Macroscopic lesions were well established by the 80th day in the vaccinated group but were only at a similar stage by the 150th day in the control animals. Histological examination of the killed animals showed that in the initial period after infection the bacilli were scanty but macrophages were numerous and had a nodular arrangement. There was evidence of bacillary lysis, and as this stage progressed, plasma-like cells became numerous. At the end of this stage, which lasted about 180 days in the unvaccinated animals and only about 70 days in the vaccinated group, the bacilli became very numerous in the connective perivascular cells, and there was no evidence of lysis in these macrophages.

The effect of BCG vaccination is therefore to shorten the initial involute stage of the disease of the normal hamster, and the vaccination does not appear to activate the lytic properties of the macrophages, as is reported to occur in the guineapig. *S. R. M. Bushby*

HELMINTHIASIS

In this section abstracts are arranged as far as possible in the following order:—TREMATODES (*schistosomes, other flukes*); CESTODES (*Diphyllobothrium, Taenia, Echinococcus, other cestodes*); NEMATODES (*Hookworms, Ascaris, Filarial worms, Dracunculus, etc., Trichuris, Enterobius, Trichinella, etc.*).

BIRCH, C. L. & ANAST, B. P. **The Changing Distribution of Helminthic Diseases in the United States.** *J. Amer. Med. Ass.* 1957, May 11, v. 164, No. 2, 121–6. [17 refs.]

"There has been an increased incidence of parasitic and tropical diseases in the United States. A redistribution of helminths is partially responsible for the increase in parasitic diseases. This redistribution is a result of several factors. Masses of people migrating from the southern states to the northern states bring with them Ancylostoma duodenale hookworm), Trichuris trichiura (whipworm), and Ascaris. Thousands of people are arriving from the West

Indies and other endemic areas, bringing with them Schistosoma mansoni, filaria, and other parasites. Two million American tourists have visited foreign countries since World War II. If they remain temporarily in endemic regions, they may bring the infections back with them. Economic aid to underdeveloped countries requires that United States personnel travel to these countries. Need of raw materials demands commercial representatives in endemic areas, and members of the armed forces often are stationed in such areas.

"Ameba, Enterobius vermicularis (pinworm), and Giardia have been present in northern cities for years. Ancylostoma duodenale, Trichuris trichiura, and S. mansoni began to appear about 1950. A survey of Chicago hospitals revealed 58 cases of schistosomiasis during 1955. The probable number of infected persons is 2,200, calculated on the percentage of those harboring the parasite in the endemic areas from which they came. In New York City the calculated number of cases is 70,000. A study of the stools of 89 persons from endemic regions showed only 17 persons without parasites, while 23% showed ova of S. mansoni. This group harbored 13 different types of parasites.

"The spread of parasites depends more on sanitation and hygiene than on climate. If the rules of sanitation and hygiene are followed, these parasites are not likely to become endemic."

MUIRHEAD-THOMSON, R. C. **The Ecology of Vector Snail Habitats and Mosquito Breeding-Places. The Experimental Approach to Basic Problems.** *Bull. World Health Organization.* Geneva. 1958, v. 19, No. 4, 637–59. [Numerous refs.]

The author, an acknowledged authority on mosquito biology for many years, attempts in this paper a review of his own special field of experience in the ecology of mosquito larvae, with special regard to how it may clarify the difficulties and problems which face those concerned with the control of snail hosts of schistosomiasis. Note is made that information on the hydrobiology of small collections of water in the tropics is largely to be found only in entomological work bearing on mosquitoes and malaria; too much attention has otherwise concentrated on the ecology and limnology of temperate climate waters or large expanses of water (lakes, etc.) in the tropics in relation to fisheries. It is admitted that, at present, the taxonomic difficulties of the molluscs are greater than those which the entomologist faced in malariology. Attention is then turned to discussing separately several factors which have importance in the understanding of the specific requirements of mosquito larvae and which deserve further study in relation to the molluscan hosts of schistosomes, *viz.* water temperature, dissolved oxygen, water movement, organic matter and pollution and salinity, predation, and side effects of insecticides on snail populations. Sampling methods are also discussed.

The paper points the advantages which both entomologists and malacologists would derive from closer study of the methods and findings of research in fresh-water ecology. In general, a case is made for intensifying the experimental approach to snail ecology and, indeed, also to mosquito larval ecology. In both fields, useful beginnings are not lacking and should be encouraged and

extended. The author is not unmindful of his lack of practical activity in research in schistosomiasis and of the fact that this paper is an introductory essay only. *D. S. Bertram*

NAGATY, H. F., RIFAAT, M. A., KHALIL, H. M. & ESSAWY, M. A. **Oxyphenonium Bromide and other Drugs as Ameliorating Factors against Acute Toxic Manifestations of Tartar Emetic Therapy.** *J. Egyptian Med. Ass.* 1958, v. 41, Nos. 5/6, 251–7.

" 1—Oxyphenonium bromide (Antrenyl) was tried with the aim of abolishing or ameliorating some of the immediate toxic effects following tartar emetic injections. The drug was ineffective regarding headache, giddiness, aching pains, chest oppression and cough. Some improvement, though not exceeding 45%, took place regarding nausea, vomiting and sweating, which symptoms are due to vagal stimulation. Similar improvement took place regarding vasovagal attacks and fainting which are due to stimulation of the same nerve.

" 2—Antistine, intravenously, Histadyl pulvules by mouth and Novalgin intravenously had no effect in this respect. Toxic reactions developed with the former drugs."

ABOU-GAREEB, A. H. **An Epidemiological Approach to the Control of Bilharziasis in Egypt.** *Indian J. Pub. Health.* 1958, Oct., v. 2, No. 4, 280–94, 2 maps, 2 charts & 2 figs. [22 refs.]

A general account and review of the position with which readers of this *Bulletin* will be familiar.

FERGUSON, F. F., OLIVER-GONZALEZ, J. & PALMER, J. R. **Potential for Biological Control of *Australorbis glabratus*, the Intermediate Host of Puerto Rican Schistosomiasis.** *Amer. J. Trop. Med. & Hyg.* 1958, Sept., v. 7, No. 5, 491–3.

" Field trials are demonstrating the valuable suppressive effect of interspecific competition by *Marisa cornuarietis* on *Australorbis glabratus*, the snail intermediate host of Puerto Rican schistosomiasis. *Marisa* colonies were established easily in ten of sixteen farm ponds planted manually with the snail. Eight of the ten ponds originally contained *Australorbis*. By about 2 years after planting, *Australorbis* had disappeared from all eight of the ponds, in an average time of 8 months. Widespread planting of *Marisa* in one endemic watershed has practically eliminated the schistosome host there in less than 2 years. *Marisa* is now being used as an adjunct to other types of *Australorbis* control by the insular government.

" Among other snails under study *Helisoma duryi eudiscus* shows definite promise of useful competition in irrigation tanks. *Tarebia granifera manuensis* appears to be effectively crowding *A. glabratus* in some areas, while *Ampullaria* sp. has been ineffective.

" Other than snails, there apparently are few natural enemies of *Australorbis* in Puerto Rico."

[See also this *Bulletin*, 1956, v. 53, 1445, 1446.]

LAGRANGE, E. Infections à *Schistosoma mansoni* chez la souris infestée par les cercaires d'un seul planorbe infesté lui-même par un seul miracidium. [*Schistosoma mansoni* **Infections in Mice infected by Cercariae from Single Snails infected with Single Miracidia**] *Riv. di Parassit.* Rome. 1958, July, v. 19, No. 3, 183–6.

The English summary appended to the paper is as follows:—

"Infected with *S. mansoni* (each of them with a single miracidium) eleven *Planorbis* have been used to infect altogether 23 mice, each mouse receiving only cercariae of one of these infected snails. All these infections did prove unisexual and sterile except in one mouse, where a couple and a few immature eggs were found in the mesentery."

DE MEILLON, B. & PATERSON, Shirley. **Experimental Bilharziasis in Animals. VII. Effect of a Low-Protein Diet on Bilharziasis in White Mice.** *South African Med. J.* 1958, Nov. 8, v. 32, No. 45, 1086–8, 2 figs.

The authors have for some time been interested in the possibility that repeated reinfections with schistosomiasis, or a low protein dietetic intake, might adversely affect the host. In the Union of South Africa, the recent intensive development of investigation in areas in which *S. mansoni* occurs may lead to repeated infections and the protein intake of some of the Bantu is low.

Repeated infection in mice, however [see this *Bulletin*, 1957, v. 54, 1101], is associated with immunity and with mild pathological effects.

Studies on the effect of low protein intake were completed some time ago but the significance of the results was not realized for the low percentage of egg passers found in the experimental mice was believed to be due to poor infecting material. After learning of unpublished work in America from which it had been concluded that the low protein diets had interfered with the reproductive development of the worms, and since De Meillon and Paterson had expected more severe pathological changes, they re-examined their material and concluded that the mice on a low protein diet were not passing many ova because the ova were held up in the tissues in the gut wall by a granulomatous reaction. Further, the male worms, at least, were not normal. Their results confirmed the finding that host diet may have a rather drastic effect on the worms. In view of this, publication was withheld until after the appearance of the American work [see *ibid.*, 1957, v. 54, 1205].

The results and conclusions of the authors are as follows:—

A low-protein diet causes infected mice to die earlier than uninfected mice but the rates of reproduction or weight gain are unchanged.

Male worms recovered from mice on a low-protein diet are smaller and their reproductive organs are abnormal.

Mice on a low-protein diet pass fewer eggs in the faeces than mice on a normal diet. The females being fertilized by imperfectly developed males may lay fewer eggs, or the eggs resulting from such a union may be abnormal and may stimulate a granulomatous reaction more readily.

The increased absorption of eggs by mice on a low-protein diet and their failure to appear in the faeces are more likely to be related to disturbances in the reproductive organs of the worms, with the consequent deposition of

abnormal eggs, rather than to an enhancement of defence mechanisms in the host produced by the low-protein diet. *W. E. Kershaw*

LARIVIÈRE, M. & BUTTNER, A. *Cricetomys gambianus* (Waterhouse). Hôte expérimental de *Schistosoma mansoni*. [*Cricetomys gambianus* **as an Experimental Host of** *Schistosoma mansoni*] *Méd. Afrique Noire*. Dakar. 1958, Oct. 1–15, v. 5, No. 19, 435–6. [29 refs.]

The frequent occurrence of the Gambian pouched rat (*Cricetomys gambianus*) in zones of endemic schistosomiasis (in French Equatorial Africa, Gambia, Nigeria, Congo, etc.) led to the experimental investigation of the susceptibility of this rodent to infection with a South American strain of *S. mansoni*. The animals were exposed either to 500 or to 2,000 cercariae. After a massive infection with cercariae the animal was unaffected clinically during the period of maturation of the worms, but after 40 days, when eggs were being deposited, it began to show signs of disease and died 4 to 5 days later. On post-mortem examination viable eggs were found to be plentiful in the liver, spleen and lungs. Some of the adult worms showed hermaphroditic tendencies.

It is concluded that the Gambian pouched rat is highly susceptible to infection with *S. mansoni*, on account of the ease with which it can become infected and the subsequent course of development of the infection.

J. J. C. Buckley

TORREALBA, J. F., SCORZA, J. V. & DAGERT B., Cecilia. **The Experimental Infection of some Wild Mammals from Venezuela with** *Schistosoma mansoni*. **1. Studies on the Susceptibility of Wild Mammals from an Epidemiological Point of View.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1958, Nov., v. 52, No. 6, 565–9, 9 figs. on 2 pls. [19 refs.]

The susceptibility of 12 different kinds of wild mammals in the State of Guarico, Venezuela, to infection with a Venezuelan strain of *Schistosoma mansoni*, was tested. The animals, which are common along the rivers in endemic areas, are as follows: (1) *Didelphis marsupialis*, (2) *Calluromys trinitatis venezuelae*, (3) *Cebus nigrivittatus*, (4) *Cerdocyon thous*, (5) *Herpailurus jaguarundi*, (6) *Sciurus granatensis griseogena*, (7) *Echymis semivillosus punctatus*, (8) *Dasyprocta rubrata*, (9) *Sylvilagus floridanus valenciae*, (10) *Hydrochoerus hydrochoeri*, (11) *Cuniculus paca*, (12) *Pecari tajacu torvus*.

Dasyprocta rubrata, *Hydrochoerus hydrochoeri* and *Pecari tajacu torvus*, which are predominantly aquatic, were exposed to 10,000 cercariae each; the others to 5,000 cercariae each. The cercariae were obtained from 20 naturally infected snails (*Australorbis glabratus*).

The animals were classified into 4 groups, and the results are as follows:—

I. *Cerdocyon thous*. No evidence of infection, macroscopic or microscopic, was found.

II. *Sciurus granatensis*, *Calluromys trinitatis*, *Cuniculus paca*, *Sylvilagus floridanus* and *Dasyprocta rubrata* passed no eggs in the faeces but showed limited infection by worms localized intrahepatically and in the large mesenteric veins which go through the pancreas. Eggs were seen in these organs and caused large fibrous granulomata.

III. *Didelphis marsupialis, Herpailurus jaguarundi, Cebus nigrivittatus, Echymis semivillosus* and *Hydrochoerus hydrochoeri* showed large numbers of well-developed worms in the mesenteric venules mainly. The eggs were retained in the intestinal submucosa where they formed pseudotubercles or were carried to the liver and caused intense inflammatory lesions resulting in lysis and phagocytosis of the miracidia.

IV. *Pecari tajacu torvus* (peccary). Two of these animals (young) were exposed and neither showed clinical signs of the disease. Well-developed adult worms were found in copula in the haemorrhoidal veins and living eggs were seen in the submucosa of the colon and rectum surrounded by small infiltrations of round cells. Most of the egg shells were ruptured and from some of these the miracidium had emerged and was surrounded by a cellular infiltration. Many eggs were present in the faeces. The liver, pancreas, lungs and small intestine were almost normal in appearance.

Discussing the results, the authors remark that the peccary has the largest index of infection of the mammals tested and, all things considered, are led to the conclusion that this animal may be an excellent potential reservoir. "We consider it necessary to investigate the peccary from endemic regions of *S. mansoni* exhaustively, in order to prove its role as a disseminator of this parasite. We note the wide distribution of this genus in America, and its custom of living in large herds along the muddy river banks of endemic areas."

In its susceptibility to and tolerance of *S. mansoni*, the peccary, which belongs to the family Suidae, differs markedly from the domestic pig which hitherto has been found refractory to experimental infection with *S. mansoni* [see also this *Bulletin*, 1956, v. 53, 896]. *J. J. C. Buckley*

CHENG, Chao-Ling, YÜ, Po-Jung & TENG, Yi-Ta. **Schistosomal Cirrhosis and Hepatoma with Spontaneous Rupture. Report of a Case with Autopsy.** *Chinese Med. J.* Peking. 1958, Nov., v. 77, No. 5, 452–6, 2 figs. on pl.

SADUN, E. H.; LIN, Sung Shen; WILLIAMS, J. E.; WALTON, B. C. **Studies on the Host Parasite Relationships to** *Schistosoma japonicum*. **I. The Effect of Single Graded Infections and the Route of Migration of Schistosomula** [SADUN, LIN & WILLIAMS]. *Amer. J. Trop. Med. & Hyg.* 1958, Sept., v. 7, No. 5, 494–9, 1 fig. **II. Quantitative Changes in the Concentration of Serum Proteins in Humans and Rabbits** [SADUN & WALTON]. *Ibid.*, 500–504, 1 fig.

i. About 200 young adult male suckling white mice were infected on one occasion with graduated doses of *Schistosoma japonicum* cercariae. The LD50 was 58 cercariae. Death was due primarily to the thrombosis resulting from large masses of adult worms in very heavy infections and to the effects of oviposition in lighter infections.

The number of adult worms removed was a little over half of the number of cercariae to which the animal had been exposed whatever the number of cercariae; more male than female schistosomes were reared in each group.

The route of migration was investigated by serial sections cut from selected tissue from 11 adult mice, and in entire sections of 7 suckling mice. The

recovery of adults in these suckling mice as estimated by section means that few were likely to have been overlooked.

One day after infection all those recovered were in the skin except for one in the pleural and one in the peritoneal cavities. Most of the cercariae had reached the subcutaneous tissues. Two days after infection most had migrated to the lungs, and three days after infection, though some were still in the skin, those in the lungs were in the alveolar walls, and some had reached the liver where they were equally distributed between the parenchyma at the anterior face of the liver and the portal vein. One young worm was found in the heart muscle, one in the mediastinal tissue, and two in the pleural cavity. Four days after infection, all but one recovered were in the liver, and for the next four days the immature flukes were equally distributed in the parenchyma, capillaries, central veins and the portal veins.

ii. The changes in the serum proteins during the first 7 months of infections with *Schistosoma japonicum* in 134 rabbits were followed by paper electrophoresis.

Little change occurred before eggs were deposited, when the gamma globulins suddenly increased (to remain so until at least the seventh month), and the albumins simultaneously diminished, but the total proteins were increased.

The sera from 63 human patients showed an increase in the total proteins and in the relative proportions of alpha 2, beta and gamma globulin fractions, with a decrease in the relative proportion of albumin. *W. E. Kershaw*

ARCHER, D. M. & HOPKINS, C. A. **Studies on Cestode Metabolism. V. The Chemical Composition of** *Diphyllobothrium* **sp. in the Plerocercoid and Adult Stages.** *Exper. Parasit.* New York. 1958, Nov., v. 7, No. 6, 542–54, 3 figs. [13 refs.]

SANDBERG, E. Cysticercosis cerebri. Et tilfaelde verificeret ved operation. [**Cysticercosis cerebri. A Case verified by Operation**] *Nordisk Med.* 1958, Dec. 11, v. 60, No. 50, 1788–9, 1 fig. [20 refs.]

The English summary appended to the paper is as follows:—

"In Scandinavia cysticercosis cellulosae, especially the intracranial form, cysticercosis cerebri, is a very uncommon disease. The clinical manifestations, prognosis and treatment are discussed. A case is reported, in which the cysticerci were successfully removed by operation, the first case in the Scandinavian literature. The period of observation was four years. The patient had become infected in South-America."

DENISOFF, N. & HAENECOUR, F. Nouveau cas de cysticercose généralisée dans l'Est congolais. [**A New Case of Generalized Cysticercosis in the Eastern Belgian Congo**] *Ann. Soc. Belge de Méd. Trop.* 1958, June 30, v. 38. No. 3, 529–30, 1 fig. on pl.

The English summary appended to the paper is as follows:—

"Intense parasitism by cysticerci of Taenia solium apparently only affecting the muscles. More than 150 calcified specimens in a 15 year old child."

Di Bello, R., Rimini, R. & Roca Estevez, A. Quiste hidático de la cara posterior del ventriculo izquierdo con onda Q patológica. [**Hydatid Cyst of the Posterior Face of the Left Ventricle with Pathological Q Wave**] *An. Facul. de Med. Montevideo.* 1958, May–June–July–Aug., v. 43, Nos. 3/4, 59–66, 3 figs. [56 refs.] English summary.

Fanci, U. Indagini sulla diffusione dell'anchilostomiasi in Abruzzo. [**The Extent of Ankylostomiasis in the Abruzzo Region**] *Ann. d. San. Pubblica.* Rome. 1958, July–Aug., v. 19, No. 4, 809–41, 1 map & 5 figs. [Numerous refs.] English summary.

Abruzzo region occupies the area between the North-Eastern Apennines and the Adriatic and is made up of a mountainous, a hilly, and a coastal area. Ankylostomiasis is prevalent in the coastal strip and in the foothills where the soil and climate are suitable for survival of the larvae. Of the four provinces, two, Chieti and Teramo, are principally affected, the others are not.

The author gives an exhaustive description of the geological and topographical features of the area and emphasizes that the general sanitary conditions are extremely primitive as are also the habits of the agricultural workers, and that these are the prime causes of the extensive degree of hookworm infection.

An investigation conducted in 1953 in 18 communes of Chieti province showed 13 to be infested. The blood of 18 men and 12 women, in whose faeces *Ancylostoma* ova were found, was examined. Nearly all the subjects were shown to have definite erythropenia, many had a lemon-yellow coloration of the skin and oral mucosa, with a tendency to haemorrhages, and none had a haemoglobin higher than 75%. The majority showed an eosinophilia and in 4 these cells had a vacuolated protoplasm which the author considers was probably due to a toxic action from the parasite.

The workers go barefoot and are ignorant of the most elementary rules of hygiene so that these factors favour a still wider dissemination of infection, and a number seem to be " healthy " carriers and are thus liable to escape any clinical examination.

For prophylaxis the author lays strong emphasis on the necessity for dealing with the infected soil, while treatment of the patients must be accompanied by education as to the danger and manner of infection. He also suggests that examination of the faeces should be carried out in all cases of anaemia resistant to the usual forms of treatment. In addition a complete survey of the area should be made in order to determine the full extent of the disease.

[Fanci mentions that he found infection by *Necator americanus* in persons who had returned from areas where this parasite occurs but does not state what infection was found in the 30 patients whose bloods were examined. No mention is made of the presence of *Necator* in Italy in Manson's *Tropical Diseases,* 14th edition (this *Bulletin,* 1955, v. 52, 311).] *W. K. Dunscombe*

Brown, H. W. & Perna, V. P. **An Overwhelming** *Strongyloides* **Infection.** *J. Amer. Med. Ass.* 1958, Nov. 22, v. 168, No. 12, 1648–51, 7 figs.

This is a remarkable account of the conditions found in a woman of 58 who was admitted to hospital in New York early in 1954 with massive gastro-

intestinal bleeding. She had been born in Panama but had lived in New York City for 36 years. She was found to have a diverticulosis of the large intestine, and a partial sigmoidectomy was done, accompanied by a transverse colostomy. She had occasional diarrhoea and continuous loss of weight. Some 10 months later she re-entered hospital for repair of an abdominal hernia at the site of her colostomy incision. Soon after discharge, she had increasing episodes of vomiting. In February 1955, her leucocyte count increased from 13,000 to 23,000 per cmm., and she soon developed fever, headache and meningeal signs. Lumbar puncture revealed a cloudy fluid with 8,000 leucocytes per cmm., mostly polymorphonuclear. Gram-negative rods were found in this fluid and in the blood, urine and throat, and were identified as *Escherichia coli*. The patient rallied for a day, but next day developed pulmonary oedema and died, a year after her first admission despite appropriate therapy throughout.

Autopsy confirmed the presence of bronchopneumonia and purulent meningitis. In addition there was a diffuse infection of *Strongyloides* larvae and the microscopic findings are described in detail. The parasites were surrounded by varying infiltrations of cells, which in places included giant cells, eosinophils and evidence of acute or chronic inflammation. The appearances are illustrated in 7 photomicrographs.

Filariform larvae of *Strongyloides* were found in small branches of the pulmonary artery, in the alveoli and their capillaries, in subpleural and intrapulmonary lymphatics. They were also found in focal granulomata in the portal areas and hepatic lobules, in the portal lymphatics, gall bladder, pancreas, adrenals and thyroid, and mesenteric lymph nodes and colon (one larva had penetrated into the peritoneal cavity). Rhabditiform larvae were found in the gastric glands, the mucosa, and in the duodenum and jejunum. Adult worms were found in the stomach, and 79 were found in one microscopic field in a portion of the jejunum. Eggs were found in the gastric glands and stroma.

The immediate cause of death was the intense *Escherichia coli* septicaemia and meningitis and it is thought that the migrating larvae could have repeatedly carried *E. coli* into the blood stream: a person as debilitated as this patient would have been very susceptible to bacterial infection. The massive larval invasion, especially of the lungs, would have contributed to death. All the circumstances suggested that the *Strongyloides* infection was due to the hyperinfective cycle of the parasite and that it is unlikely that infection occurred during the patient's residence in New York. *H. J. O'D. Burke-Gaffney*

Miura, U., Kugimoto, M., Otsuji, K., Sugawara, K., Ozawa, T., Shoji, H. & Hashimoto, S. [**Studies on Sanitary Treatment of Night-Soil by Heating Process utilizing Surplus Midnight Electric Power**] *Japanese J. Nation's Health.* 1958, Sept., v. 27, No. 3, 153–61, 2 figs. [In Japanese.]

The English summary appended to the paper is as follows:—

"In recent years the surplus electric power in midnight has greatly increased, amounting to 300–400 million kwh per year in Kansai district, Japan. Utilizing this surplus electric power, practical application of sanitary treatment of night-soil used for fertilization was intended, and a test plant of night-soil treatment by heating process was constructed in Osaka City in co-operation of

Osaka City, Kansai Electric Power Co., and Higashiyodogawa Agricultural Co-operative Union in Feb., 1956.

"The plant consisted of a treatment tank with a capacity of 5·5 cubic meters and two storage tanks. The night-soil in the treatment tank is heated up to 60°C. at night by the flow of electric current between electrodes placed on opposite sides of the tank. The consumption of electric power for the treatment of 1 cubic meter of night-soil was 51 kwh on the average throughout a year.

"The following are the results of observations made on the germicidal and ovicidal effect of the treatment.

"1) By the treatment of night-soil ascaris eggs were completely exterminated and MPN of fecal coli were reduced to about 10–10^2/cc from 10^5–10^6/cc of the untreated night-soil. But in the scum produced over the surface of the night-soil, fecal coli were found in greater numbers as compared with those found in the liquid parts of night-soil. Occasionally two percent of ascaris eggs were found alive in the scum of the treatment tank, but they were totally destroyed in the storage tank.

"2) In summer MPN of coliform bacteria in the soil fertilized with treated night-soil were about 10^2–10^3 per gram of soil as compared with 10^4 per gram in the soil fertilized with untreated night-soil. In winter, however, there was no difference in MPN of coliform bacteria between the two soils, both being 10^2–10^3 per gram of soil.

"3) No difference was found in the number of azotobacter contained in the two soils mentioned above.

"4) No embryonated ascaris egg was found in the soil fertilized with treated night-soil in the examinations made 7 to 12 months after the start of the operation, while there were 6 to 38 percent of embryonated ascaris eggs in the soil fertilized with untreated night-soil.

"5) In conclusion the treatment was regarded as almost satisfactory."

KAWAGOE, K., NISHI, H., SHIBATA, E. & YAMADA, S. [**On the Effect of Night-Soil Treatment by Heating Process utilizing Surplus Midnight Electric Power upon the Incidence of Parasite Infection of Farmers**] *Japanese J. Nation's Health*. 1958, Sept., v. 27, No. 3, 162–5, 2 charts. [13 refs.] [In Japanese.]

The English summary appended to the paper is as follows:—

"As reported in the preceding paper, a test plant for night-soil treatment by heating process utilizing surplus midnight electric power was constructed in Feb., 1956 at Idakanocho, a farm village in Osaka City, where parasite diseases were severely prevalent.

"The farmers of the village were restricted to use only the night-soil treated by the test plant for fertilization of the farm, and to consume vegetables cultivated in their own farm. Under these conditions prevalence rates of parasite infections of the farmers were investigated monthly by fecal examination, and the effect of night-soil treatment upon the incidence of parasite infection was observed during two years.

"In the first observation made for eight months without carrying out mass administration of anthelmintics, a tendency of decline in the prevalence rates of parasite infection was observed, though not very marked.

"In the second observation, however, in which mass administration of anthelmintics was carried out twice, the prevalence rates were remarkably reduced (hookworm: from 52% to 11%, ascaris: from 33% to 12%), and remained at a very low level throughout the observation of five months.

"According to these results, combined application of night-soil treatment by heating process and mass administration of anthelmintics is regarded as the most effective method of preventing parasite diseases."

GUJRAL, J. S. **Urban, Semi-Urban and Rural Filariasis in Ballia District, Uttar Pradesh.** *Indian J. Malariology.* 1958, June, v. 12, No. 2, 101–8, 1 map & 3 graphs.

"1. Results of a filaria survey, conducted separately in urban, semi-urban and rural areas of Ballia District in Uttar Pradesh, are incorporated in this paper.

"2. The entire district appears to be filarious and the problem is not confined merely to isolated pockets.

"3. Prevalent infection is exclusively *Wuchereria bancrofti* in urban as well as rural areas and the vector responsible for its spread is *Culex fatigans.* The quantum of transmission in the mosquitoes in urban areas is more than in non-urban areas.

"4. The disease has probably gradually been increasing during the last five years 1951–1955; 11·84 times in urban, 7·68 times in semi-urban and 2·55 times in rural areas.

"5. Infection, disease and endemicity rates are highest in urban, lesser in semi-urban and least in the rural areas.

"6. Average infestation (microfilaria load) in the community is also distributed in the same manner, being 28·45, 14·31 and 14·08 microfilaria per 20 c.mm. of blood in urban, semi-urban and rural areas, respectively.

"7. Infection rate in the pre-school children in urban areas is twice that in the rural areas."

SUBRAMANIAM, H., RAMOO, H. & SUMANAM, S. D. **Filariasis Survey in the Laccadive, Minicoy and Amindivi Islands—Madras State.** *Indian J. Malariology.* 1958, June, v. 12, No. 2, 115–27, 1 map.

"A filariasis survey was carried out in the Laccadive group of islands with a population of about 20,000. The islands of Kalpeni, Androth, Agathi, Kiltan, Chetlat and Kadamath were endemic for filariasis, while Minicoy, Kavarathi and Ameni were found to be free from filariasis.

"The island of Bitra could not be surveyed.

"*W. bancrofti* was the only type of infection noticed. *W. malayi* infection, *mansonioides* mosquitoes and *Pistia stratiotes* were not encountered.

"The overall filarial disease rate and infection rate were 15·5 and 11·4 respectively for all the islands where filariasis was endemic.

"*C. fatigans* was the only vector in the areas surveyed as proved by dissections."

LAVOIPIERRE, M. M. J. **Studies on the Host-Parasite Relationships of Filarial Nematodes and their Arthropod Hosts. II. The Arthropod as a Host to the Nematode: a Brief Appraisal of our Present Knowledge, based on a Study of the more Important Literature from 1878 to 1957.** *Ann. Trop. Med. & Parasit.* 1958, Oct., v. 52, No. 3, 326–45. [Numerous refs.]

Of 89 genera in the superfamily Filarioidea, the author has found that only 15 genera have been studied in their arthropod host. Over half the species, 19 out of the 35 species listed, have been shown to develop in mosquitoes, and a further 11 species in other Diptera (Ceratopogonid midges, *Sycorax, Simulium, Chrysops, Stomoxys*). Development to the infective forms has also been observed in fleas, ticks and a bloodsucking mite, as well as in a grasshopper and a biting louse, but never in *Glossina,* or in bloodsucking bugs.

The main part of the paper is a series of reviews of previously published work under the headings: (1) the uptake of microfilariae by the arthropod; (2) the migration of filariae in the arthropod from the gut to their sites of development; (3) sites in the body of the arthropod in which filarial nematodes develop to the infective stage; (4) the migration of the infective larvae from their sites of development to the point of exit from the body of the arthropod host; (5) the emergence of the infective forms of filarial worms from their arthropod hosts, and a consideration of the stimuli which induce the escape of the nematodes; (6) the effects produced by the nematode parasite on its arthropod host; (7) the effects produced by the arthropod host on its nematode parasite.

Any abstract of the closely packed information in these reviews would distort the balance the author has taken care to supply, and these subjects must be consulted in the original paper. This is a valuable review of work previously published on the behaviour of the parasites in their arthropod hosts.

[For Part I, see this *Bulletin*, 1958, v. 55, 1032.] *B. R. Laurence*

RACHOU, R. G., MOURA LIMA, M., MEMÓRIA, J. M. P., NETO, J. A. F. & AZAMBUJA, C. E. A. Quantidade de sangue ingerido pelo *Culex pipiens fatigans.* [**Quantity of Blood ingested by** *Culex pipiens fatigans*] *Rev. Brasileira Malariologia.* Rio de Janeiro. 1957, Oct., v. 9, No. 4, 505–9, 1 chart. English summary (7 lines).

The mean weight of several hundred gorged, laboratory-bred *Culex pipiens fatigans* was found to be 5·24 mgm., and wild-caught fed specimens from houses gave a mean weight of 5·16 mgm. Laboratory-bred, unfed females had a mean weight of 2·03 mgm. The mean weight of blood ingested by *C. p. fatigans* is calculated to be 3·21 mgm., with 95% confidence intervals of 3·02 to 3·40 mgm. *D. S. Bertram*

LAURENCE, B. R. & SMITH, S. A. **The Breeding of** *Taeniorhynchus* **(Subgenus** *Mansonioides***) Mosquitoes in the Laboratory.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1958, Nov., v. 52, No. 6, 518–26, 2 text figs. & 6 figs. on 2 pls.

Further progress is reported towards simplifying the rearing of *Taeniorhynchus* mosquitoes, of the subgenus *Mansonioides,* in the laboratory [see this

Bulletin, 1953, v. 50, 52; 1958, v. 55, 296]. *T. africanus, T. uniformis* and *T. annuliferus* have been cultured now for more than 12 generations. The adults mate in 25 cm. cube cages. A high humidity (70–90% RH) is maintained by draping the cages with damp lint, over which is fitted loosely a thin polythene cover. Laboratory temperature ranges between 26° and 30°C. Sugar solution and fresh apple are provided, besides blood meals on the human hand or an anaesthetized guineapig, for egg development. Gravid females lay well, if confined in 10 × 6 cm. jars ("ovipots"), on *Salvinia* plants; also on *Azolla, Lemna,* floating leaves of terrestrial plants and even cork chips. At 26°–30°C., eggs hatch in 5 to 7 days in tap water. The larvae are transferred to rearing dishes, usually 22 cm. diameter and about 10 cm. deep.

The paper compares in detail various techniques for larval and pupal development. Diluted infusions of dog biscuit, or guineapig dung, with periodic addition of biscuit or yeast, are successful and the addition of a turf of grass helps to balance the medium biologically. The use of plants for larval respiration involved numerous difficulties; "wet strength" crepe paper was found to be a useful substitute and was brought into routine use. It is preferable, however, to provide *Salvinia* plants for pupation. At 26–30°C., pupae appeared 16 to 20 days after the eggs hatched; adults emerged 25 to 40 days after eggs had been laid.

A graph illustrates that most deaths occur soon after larvae hatch, and again at pupation. Several tables summarize the relative success of different rearing techniques tried, and a line drawing illustrates an "ovipot".

[Mosquitoes of this kind present considerable technical difficulties in maintenance; it is becoming more important to be able to rear useful numbers routinely for transmission studies in filariasis. The authors have contributed substantially to this need. The paper contains excellent original photographs by S. A. Smith of a female *T. africanus* biting; an egg-mass on *Salvinia,* a larva and a pupa attached to *Salvinia* roots; a breeding dish with its turf and crepe paper; and an example of over 100 larvae attached to a piece of this paper in the way they typically do in these culture methods.]

D. S. Bertram

SAMESHIMA, H. & SATO, T. **A Case of Wuchereriasis on the Spermatic Cord.** *Kurume Med. J.* 1958, v. 5, No. 2, 87–92, 6 figs.

RACHOU, R. G. Considerações sôbre o combate à filariose bancroftiana no Brasil. [**Observations on the Control of Bancroftian Filariasis in Brazil**] *Rev. Brasileira Malariologia.* Rio de Janeiro. 1957, Oct., v. 9, No. 4, 527–36. English summary.

The problem of controlling in Brazil bancroftian filariasis transmitted by *Culex pipiens fatigans* is considered in this paper. Insusceptibility of the vector to chlorinated hydrocarbon insecticides (DDT, gamma BHC, dieldrin), the nature and number of breeding places, climatic and topographical features combine to rule out possibilities of achieving large-scale vector control by either anti-adult or anti-larval measures. Treatment, beginning in Belém in 1952, with DDT (at 2 gm. per square metre) as a residual deposit indoors, and

later changing to BHC (at 300 mgm. gamma isomer per square metre) and finally to dieldrin (at 1 gm. per square metre) gave no lasting control of the adults. The numbers of infested houses and the density of mosquitoes per house were higher three months after the dieldrin treatment than before it. It is stated that insecticide resistance has therefore developed to each of these three insecticides, though critical laboratory assay of this is not given.

Control of filariasis is at present based primarily on Hetrazan [diethylcarbamazine] treatment of patients showing microfilaraemia, and of patients with elephantiasis. A table records a decline in the microfilaraemia rate from 14·5% in 1953 to 2·5% by 1956 in a part of Florianópolis, with nearly negative infection rates in the local mosquitoes in 1956, following daily dosage in 1953 of all people with elephantiasis or microfilaraemia for 7 days at 6 mgm. diethylcarbamazine per kgm. body weight. This result is accepted as an indication that control of foci of infection by this method should be quite efficient, although vector control would be a desirable additional measure. Where funds are available locally, some mosquito control is attempted. There is also need, in combating the mosquito problem, to encourage improved methods of sanitation and the education of the people to more hygienic standards.

D. S. Bertram

MILLER, M. J. & FRANZ, K. N. **Some Clinical Aspects of Onchocerciasis in Liberia.** *Amer. J. Trop. Med. & Hyg.* 1958, Sept., v. 7, No. 5, 558–60.

Previous studies by BURCH *et al.* [this *Bulletin,* 1956, v. 53, 640] have shown that onchocerciasis is widespread in Liberia. In the present study, the presence of infection was determined by examination of skin scarification smears and by palpation for nodules. 14 of these smears were taken from each subject on each side of the body at the following levels: (1) temple, near the outer canthus; (2) shoulder, over the scapula; (3) mid-forearm, outer lateral surface; (4) wrist, extensor surface; (5) greater trochanter; (6) mid-calf, outer lateral surface; (7) ankle, outer lateral surface. The skin scarification technique involved making five superficial linear incisions about 1 mm. apart and 1–2 mm. long. Blood and tissue juices were then expressed from the incisions by pressure and stained with Giemsa or haematoxylin.

Clinical and laboratory studies were carried out on 125 adults (81 males and 44 females) chosen at random, but living in an area where onchocerciasis was endemic. Special attention was given to skin changes.

The overall infection rate with *Onchocerca volvulus* was 69% and it was 100% in those over 40 years. Specific skin changes were found in 14% of infected persons. No ocular lesions were found.

The problem of ascribing skin changes to *O. volvulus* is by no means easy, because skin abnormalities due to nutritional deficiencies are common. Many of these changes, both in infected and non-infected people, may be due to a combination of factors including faulty nutrition, trauma, previous skin diseases and possibly exposure. Habitual abortion has been ascribed to onchocerciasis [this *Bulletin*, 1955, v. 52, 472] but the authors were unable to confirm this.

The occurrence of *O. volvulus* microfilariae in hydrocele fluid may indicate

a possible relationship between it and this infection, but hydroceles were as common in the infected as in more normal people. No eye complications were encountered.

Philip Manson-Bahr

DEFICIENCY DISEASES

South Pacific Commission. Noumea, New Caledonia. **The Diet of Mothers and Children on the Island of Guam** [Malcolm, Sheila H.]. *Technical Paper No. 113.* 1958, Jan., vi + 35 mimeographed pp., 2 maps.

The title does less than justice to the scope of this interesting report, which gives a great deal of information about the health of the people of Guam. The island has a population of just about 37,000. Formerly the majority of the population were subsistence farmers, but the large U.S. Naval Station has greatly influenced the way of life. The 1956 census showed that out of 7,615 men aged 18 to 60, 6,369 were now employed by the services, government or private agencies and only 542 were "bona-fide" farmers. In addition, 1,477 females were employed. These for the most part draw good wages. The diet of the families has changed greatly as a result of the change of occupation of the inhabitants, and a larger amount of imported food is now consumed. The general health of the adult population appears good, judging by the death rate of 5·3 per 1,000. The birth rate is very high, 39 per 1,000. The infant mortality rate is also 39, which could be lowered.

The survey indicated that the rapid change over from a rural to an industrial way of life was not entirely satisfactory and many families were buying foods which did not provide sufficient of some of the essential nutrients. This was largely due to a lack of knowledge among the women of nutritional requirements and the methods whereby a limited income may be laid out to best advantage.

There is need for more education in home economics and for further training of public health nurses in nutrition. The production and marketing of local vegetables and fruits could also be improved. It is recommended that a fully trained nutritionist or dietitian should be provided to assist in implementing the general planning of a nutrition programme, which should be coordinated by a body comprising representatives of agriculture, education and public health.

The details of food consumption, wages and vital statistics are well set out in this report, which will interest all concerned with the public health of a rural community in the tropics which is rapidly becoming industrialized.

R. Passmore

Lal, S. B. & Roychowdhury, S. P. **Biological Value, by Nitrogen Balance Sheet Method, of Pressed Groundnut Cake Flour fed to Human Volunteers.** *J. Indian Med. Ass.* 1958, June 1, v. 30, No. 11, 361–4. [13 refs.]

Pressed groundnut cake was given by mouth to 5 healthy human volunteers and the nitrogen shown to be digested and well assimilated. The maximum

amount of cake incorporated in the diet on any one day appears to have been 68 gm. These experiments provide evidence that groundnut cake can be a useful addition, in small amounts, to human diets [see also this *Bulletin*, 1953, v. 50, 1160]. *R. Passmore*

CASTILLO PLAZA, A., with the collaboration of P. LIENDO COLL, E. PAEZ PUMAR, W. G. JAFFE & L. BIANCHI CAYAMA. Programa para la Rehabilitación Nutricional del Pre-escolar a base de un suplemento alimenticio ideado y elaborado por el Instituto Nacional de Nutrición. [**Programme for Nutritional Rehabilitation of Pre-School Children, based on a Nutritional Supplement Elaborated by the Venezualan National Institute of Nutrition**] *Archivos Venezolanos de Nutricion.* 1956, Dec., v. 7, No. 2, 223–57. English summary.

KINNEY, T. D. & FOLLIS, R. H., Jr. [Edited by.] **Nutritional Disease. Proceedings of a Conference on Beriberi, Endemic Goiter and Hypovitaminosis A, held at Princeton, N.J., June 1–5, 1958.** *Federation Proc.* Wash. 1958, Sept., v. 17, No. 3, Pt. 2, Suppl. No. 2, pp. viii + 162, numerous figs. [Numerous refs.]

Conferences are valuable occasions for those who attend, but their proceedings do not necessarily make interesting reading. This supplement to *Federation Proceedings* gives accounts by several speakers of various aspects of beriberi, endemic goitre and hypovitaminosis A. For the most part these are lengthy and somewhat discursive and the newcomer can find elsewhere more concise and practical descriptions of these conditions. However, for the reader who perseveres there are good things. The abstracter knows of no better account of the neurological features of beriberi than that given by DENNY-BROWN, or of xerophthalmia and keratomalacia than the one given by OOMEN.

The sections contained, respectively, 7, 6 and 6 papers, contributed by some 20 speakers. A final section consisted of a discussion on research and training in nutrition. *R. Passmore*

HOLEMANS, K. & LAMBRECHTS, A., with the technical assistance of H. MARTIN & C. HUBIN. **Calcium and Phosphorus Balances in African Children (Retention and Minimum Requirements).** *J. Trop. Pediatrics.* London. 1958, Sept., v. 4, No. 2, 43–9, 2 figs. [16 refs.]

This paper reports 39 calcium and phosphorus balance studies on 17 African boys aged 6 to 12 years. Mean figures for intake and retention of calcium and phosphorus were as follows:—

Calcium		*Phosphorus*	
Intake	*Retention*	*Intake*	*Retention*
11·2	− 0·9	18·5	− 2·8
17·5	+ 6·6	22·5	+ 1·0
22·8	+10·6	27·6	+ 9·4
64·7	+30·4	49·5	+26·0

(All figures mgm./kgm./24 hours)

Before the balance experiments started, the children were living on village diets providing calcium about 15 mgm./kgm./24 hours and phosphorus about 20 mgm./kgm./24 hours. The calcium and phosphorus retentions on the experimental diets were higher than that reported by several authors for Caucasian children.

The maintenance requirements for both minerals seemed to be of the same order as those of white children. However, when the intakes exceeded this minimum, retention was high. It is concluded that this was due to refilling of body stores, which had been depleted as a result of the poor intakes on the village diets.

No evidence was found which would suggest that these children had become adapted to the intakes of mineral, which were low by European standards.

R. Passmore

DELANOE, G. Les asystolies carentielles et organico-carentielles au Maroc. [**Asystoles due to Nutritional Deficiency alone or with Organic Heart Failure in Morocco**] *Maroc Méd.* 1958, Oct., v. 37, No. 401, 1045–62, 10 figs. [70 refs.]

The English summary appended to the paper is as follows:—

"The author describes among Moroccan people a deficiency syndrome including

1o - Proteinemia trouble,
2o - Hepatic deficiency,
3o - B Avitaminosis,
4o - Heart-failure.

"Out of 136 heart-failure cases this syndrome was found 112 times, that is 82% cases; of these 68% were due to both organic and deficiency heart-failure, while 14% to functional heart-failure caused wholly by nutritional deficiency.

"Deficiency heart-failure occurs specially in women of childbearing age. It is a congestive heart-failure, with cardiac enlargement, low voltage. Nine times out of ten, the punctures of liver show signs of precirrhotic degenerative hepatitis through protein deficiency.

"Etiology lies in underfeeding, lack of proteins and relative excess of carbon hydrates.

"Treatment requires a high protein diet, and vitamin B which gives striking results. Great improvement is obtained, though not a complete cure: malnutrition leads to irreversible biological trouble, which aggravates the prognosis of cardiac condition. Action must therefore be essentially preventive and include, besides an educative effort, reduction in tea and sugar imports, and increase in the consumption of fish, one of Morocco's greatest natural resources."

PRETORIUS, P. J. & SMIT, Z. M. **The Effect of Various Skimmed Milk Formulae on the Diarrhoea, Nitrogen Retention and Initiation of Cure in Kwashiorkor.** *J. Trop. Pediatrics.* London. 1958, Sept., v. 4, No. 2, 50–60, 4 figs. [23 refs.]

80 Bantu infants with kwashiorkor were divided into 4 groups and received dietetic treatment as follows:

1. fresh skimmed milk with 5% dextrimaltose added,
2. spray dried skimmed milk without supplement,
3. fresh skimmed milk with 5% casein added,
4. fresh skimmed milk with 6·5% carob flour added.

"Initiation of cure" was effected equally well in each group and serum albumin levels rose satisfactorily in all. The diarrhoea ceased more rapidly in the children receiving supplements of casein and carob flour, but the passage of formed stools is not considered an important sign of successful treatment. Nitrogen retention was greatest in the group receiving the casein supplement. Nitrogen balance studies indicated that an intake of 30 to 50 gm. of protein daily was sufficient to initiate cure, increase weight and raise the level of serum albumin.

It is concluded that, if skimmed milk is available, this will provide sufficient protein and expensive supplements are not necessary [see also this *Bulletin*, 1956, v. 53, 1374]. *R. Passmore*

PARYS, G. Behandeling van zware Kwashiorkor gevallen. [**Treatment of Severe Kwashiorkor**] *Ann. Soc. Belge de Méd. Trop.* 1958, June 30, v. 38, No. 3, 557–62.

The English summary appended to the paper is as follows:—

"Numerous authors agree that in spite of treatment, the death rate in advanced forms of kwashiorkor may reach 40%. The initial treatment of the disease must be energetic. Hence it is imperative to give the following associated with skimmed milk in each case:

"1o Serum given subcutaneously;

"2o Long acting penicillin to prevent intercurrent infections;

"3o Vitamins B12 and E.

"A comparative study of 2 series of patients each of which were given identical milk feeds, but one of which received each day 30 mg vitamin E and 5 γ vitamin B12 showed that those receiving the lipotropic drugs gained on an average 33 g in wt per day, against only 5·7 g for those in the control group."

SPRUE

COOKE, W. T. **Adult Coeliac Disease and other Disorders associated with Steatorrhoea.** *Brit. Med. J.* 1958, Aug. 2, 261–5. [Numerous refs.]

This is a clear and well-documented account of the subject. Particular attention is paid to the group of disorders [that have steatorrhoea as part of their presentation] in which there is no obvious contributing factor: tropical sprue, coeliac disease, and non-tropical sprue or idiopathic steatorrhoea. Diagnostic and differentiating methods are discussed at length. The author concludes:

"It is now apparent that tropical sprue, on the basis of the intestinal biopsy findings, the lack of response to a gluten-free diet, and the probability of the

folic-acid test returning to normal, must be regarded as significantly different from adult coeliac disease. Jejunitis, which could on occasion simulate adult coeliac disease, can be shown to differ by the findings on intestinal biopsy and the invariable lack of response to a gluten-free diet, and may well prove to be the non-tropical counterpart of tropical sprue.

"The condition that is known in this country as idiopathic steatorrhoea and in the United States as non-tropical sprue is now taking on more defined characteristics and deserves a distinctive name—adult coeliac disease—to replace the two previous unsatisfactory titles. In brief, it appears to be a familial constitutional disorder. . . . Four observations suggest that this is an enzymatic defect and probably associated with folic acid metabolism. These are as follows: the rapid haematological remission in some patients on a gluten-free diet [this *Bulletin*, 1958, v. 55, 683]; the abnormal folic-acid-excretion test [*ibid.*, 1954, v. 51, 96]; the rise of blood glutamine following gluten administration in some patients . . ; and the abnormality in which pteroylglutamates may be involved and which lead to the persistent excretion of *p*-hydroxyphenylacetic acid, not easily eliminated by administration of ascorbic acid. . . . As to where this enzymatic defect is sited—whether in the intestinal cell or liver—future research must show. It cannot, however, be too strongly emphasized that the actual absorptive functions of the intestinal cell are relatively minor compared with the major metabolic functions that it performs."

Charles S. Leithead

PIPER, D. W. **The Malabsorption Syndrome.** *Med. J. Australia.* 1958, Aug. 23, v. 2, No. 8, 252–4. [29 refs.]

SMITH, K. V. **The Malabsorption Syndrome.** *Ibid.*, 255–6, 4 figs. on pl.

These papers review and discuss the physiology of the malabsorption syndrome with some reference to tropical sprue.

HAEMATOLOGY

COTTER, Helen & WALSH, R. J. **Haemoglobin Values in some Pacific Native Groups.** *Med. J. Australia.* 1958, Nov. 1, v. 2, No. 18, 603–5.

Continuing their survey of Pacific islanders [this *Bulletin*, 1958, v. 55, 803], the authors estimated the Hb content of adult bloods from several localities (the specimens often had to be sent long distances). For male subjects, the average Hb contents, in gm./100 ml. were:—

1. In parts of Dutch New Guinea, 12·1 ± 0·201 to 12·91 ± 0·152;
2. In the British Solomon Islands, 13·78 ± 0·233;
3. In the Kukukuku tribe, 14·07 ± 0·322;
4. In Medical orderlies at Port Moresby, 14·22 ± 0·318;
5. In the Chimbu tribe, 14·86 ± 0·132.

In the first three groups malaria, hookworm infection and malnutrition were rife, but the Kukukuku, a tribe recently cannibal, was of good physique. In the Chimbu tribe these factors were of less importance, and the effect of an altitude of 5,000 to 8,000 ft. was added. *Alan B. Raper*

BUDTZ-OLSEN, O. E. **Haptoglobins and Haemoglobins in Australian Aborigines, with a Simple Method for the Estimation of Haptoglobins.** *Med. J. Australia.* 1958, Nov. 22, v. 2, No. 21, 689–93, 1 fig. [26 refs.]

"1. A simple method for the determination of the haptoglobin groups is described; it is hoped that this method will make surveys of different peoples in different parts of the world easier and more rapid in the future.

"2. No abnormal haemoglobins were found in a sample of central Australian and in another sample of northern Australian aborigines.

"3. The haptoglobin distributions in these two groups were entirely different. They were also different from the distribution in white peoples of European origin and in two groups reported in West African Negroes."

LAMBOTTE-LEGRAND, J. & LAMBOTTE-LEGRAND, C. Notes complémentaires sur la drépanocytose (Sicklémie). III.—Les salmonelloses dans l'anémie drépanocytaire et microdrépanocytaire. [**Notes on Sicklaemia. III.** *Salmonella* **Infection in Sickle-Cell Anaemia and in Thalassaemia–Sickle-Cell Disease**] *Ann. Soc. Belge de Méd. Trop.* 1958, June 30, v. 38, No. 3, 535–45. [Numerous refs.]

The English summary appended to the paper is as follows:—

"The authors add 12 new personal cases seen in Negro children at Léopoldville (Belgian Congo) to the 44 cases of sickle-cell anaemia associated with a salmonella osteomyelitis. Does a predisposition for the salmonelloses in general exist in these patients? A 4th case of thalasso-drepanocytotic anaemia associated with a salmonella osteomyelitis is described; this association seems to be as frequent as that reported above. A case of salmonella meningitis has also been seen in a child suffering from micro-drepanocytotic anaemia."

[For Parts I and II, see this *Bulletin,* 1958, v. 55, 1271.]

YÜ, Chih-Fei. **The Incidence and Clinical Significance of Stainable Iron in Bone Marrow.** *Chinese Med. J.* Peking. 1958, Oct., v. 77, No. 4, 347–55, 10 figs. (9 on 2 pls.)

The Prussian blue staining method was applied to marrow smears from 21 normal subjects, 18 patients with no anaemia, 37 patients with iron deficiency (in 14 due to hookworm), and 86 patients with anaemia not due to lack of iron (mostly cases of sepsis), all in Hangchow, China. A separate assessment was made of the iron lying extracellularly, and that in red cell precursors ("sideroblasts").

The results were in accordance with expectation. In normal subjects and patients without anaemia, sideroblasts formed from 19% to 94% of the nucleated red cells, and extracellular iron deposits were always present.

Abundant extra- and intracellular iron was found, after multiple transfusions, in aplastic anaemia, leukaemia, and megaloblastic and haemolytic anaemias. In iron-deficiency anaemia sideroblasts were usually absent, and never exceeded 28%; iron deposits were invariably absent. A combination of heavy iron deposits with low sideroblast counts was found in the anaemias of infection, uraemia, cirrhosis of the liver, and neoplasia. It is the main purpose of the paper to draw attention to this dissociated picture of iron distribution, and to the relevance of a study of the bone-marrow iron to the planning of iron therapy. *Alan B. Raper*

TASKER, P. W. G. **Refractory Nutritional Megaloblastic Anaemia.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1958, Nov., v. 52, No. 6, 574–9, 2 figs. [19 refs.]

In many tropical anaemias the response to folic acid, vitamin B12, and iron is less predictable than in the anaemias of temperate climates. An assessment of the effect of malnutrition on the efficacy of these drugs was called for.

This admirably concise paper from Kuala Lumpur concerns the response to treatment of 42 Indian and Chinese patients with iron deficiency, and 35 with megaloblastic anaemias (the latter after a control period with iron alone). The first group received 2 to 3 gm. of parenteral iron daily for 15 days, and the second 10 to 20 mgm. of folic acid daily. The response, judged by the rise in Hb concentration, red cell count, and packed cell volume at the end of 15 days, was evaluated against the state of nutrition as measured by the serum globulin concentration.

In each group the increase in Hb concentration was not significantly dependent on the degree of malnutrition, and for the iron-deficient subjects the response in red cell production showed but little relationship to the initial serum protein level. But in the megaloblastic anaemias, red cell production was significantly related to the initial red cell count and the level of serum globulin. A regression equation relating these three factors could be derived, and after the effect of the initial red cell count had been allowed for, a partial correlation coefficient could be calculated, showing that the rise in red cell count bore a significant inverse relation to the serum globulin level.

It is conjectured that since iron is incorporated into haemoglobin in a metabolically simple manner, the process might be little affected by the enzymic defects of malnutrition; but that folic acid, being a precursor of co-enzyme systems concerned in nucleic acid synthesis, might depend for its effect on the efficiency of these systems. The action of folic acid might be impaired either by the lack (caused by malnutrition) of associated enzymes, or by the failure of an impaired liver to convert it to the metabolically active folinic acid. In other words, in these patients iron deficiency responded to parenteral iron whatever the nutritional state; while a high serum globulin level indicated that the response of a megaloblastic anaemia to folic acid would be poor.

[See also this *Bulletin,* 1956, v. 53, 237.] *Alan B. Raper*

VENOMS AND ANTIVENENES

YANG, Chen-Chung, IWANAGA, Sadaaki & KAWACHI, Saju. **Biochemical Studies on the Formosan Snake Venoms. II. Some Observations on the Column Chromatography of Cobra Venom.** *J. Formosan Med. Ass.* 1958, Aug. 28, v. 57, No. 8, 525–32, 4 figs. [16 refs.]

"1. Gradient chromatography of cobra venom on a column of carboxymethyl-cellulose was performed and the distribution of enzyme activities in each fraction was determined.

"2. Seven protein fractions were obtained and the presence of two kinds of phosphodiesterase which separated completely from phosphomonoesterase and 5′-nucleotidase was also confirmed.

"3. There are two kinds of nucleic acid related compounds in cobra venom. They have maximum absorption around 252 mμ and 257 mμ respectively, and can be separated by means of column chromatography with carboxymethyl-cellulose. Cobra venom also possesses two strong basic protein fractions.

"4. The enzymes or proteins in cobra venom were very stable when preserved for a long time such as for seventeen years in a desiccator, and the gradient column chromatography we performed was well reproducible. The chromatographic procedure was thought to be very suitable for the purpose of separation and purification of cobra venom."

CANTORE, G. P. & BETTINI, S. Contributo allo studio del veleno di *Latrodectus tredecimguttatus* Rossi. [**Studies on the Venom of** *Latrodectus tredecimguttatus*] *Rendiconti Istituto Superiore di Sanità.* Rome. 1958, v. 21, Pt. 9, 794–805, 4 figs. [38 refs.]

The English summary appended to the paper is as follows:—

"The chemical composition of *Latrodectus tredecimguttatus* Rossi has been studied. Homogenates of the poison glands were separated electrophoretically into five protein components. Proteolytic activity was observed only with the fresh venom of this spider. Anti-cholinesterase activity was found only against true-cholinesterase and not against pseudo-cholinesterase. An active peak was also found for hyaluronidase but no hemolytic activity could be detected either *in vivo* or *in vitro*. Finally, a clear inactivation of the venom by trypsin, pancreatin and clorophyll was shown."

CICARDO, V. H. Mecanismo de la hipertensión arterial producida por la ponzoña de *Latrodectus mactans*. [**Mechanism of Arterial Hypertension Produced by the Bite of** *Latrodectus mactans*] *Semana Méd.* 1958, Oct. 23, v. 113, No. 17, 776–7. [18 refs.]

TOXOPLASMOSIS

CARDELLE, G., CURBELO, A. & DIAZ CARRAL, María Del C. Toxoplasmosis. II. Resultados de la intradermoreacción a la toxoplasmina en la población sana de La Habana. [**Toxoplasmosis. II. Results of Intradermal Tests with Toxoplasmin on Healthy Persons in Havana**] *Rev. Cubana Lab. Clin.* 1958, Oct.–Nov.–Dec., v. 12, No. 4, 97–101. [17 refs.]

The English summary appended to the paper is as follows:—

"Intracutaneous injections with toxoplasmin, prepared with toxoplasmin, prepared with mouse peritoneal exudate following Frenkel technic were performed in one hundred individuals resident of the city of Havana, and ranging in age from newly born to 60 years.

"The incidence of toxoplasmic infection increased with the age, being 0 in the newly born to 4 years; 11·4 from 5 to 9 years; 21% between 10 to 14 years and 45% from 15 to 20 years; as has being shown in other localities.

"Even when these results are not necessarily applicable to the whole Cuban population, they have shown the high incidence of toxoplasmic antigen sensitivity among Cuban individuals as a testimony of the frequency of inapparent infections in this area."

VARELA, G., ROCH, E., CURBELO, A., MÁRQUEZ, V., GARDELLE, G. & MARRERO, E. Los anticuerpos de *Toxoplasma* en la población sana adulta de La Habana. [*Toxoplasma* **Antibodies in Healthy Adults in Havana**] *Rev. Cubana Lab. Clin.* 1958, Oct.–Nov.–Dec., v. 12, No. 4, 95–6.

The English summary appended to the paper is as follows:—

"The Sabin Feldman dye-test for the diagnosis of toxoplasmosis was performed in 100 healthy adults in the city of Havana between 20 and 40 years of age. The results were the following: 71 were negative and 29 positive (1:16,1; 1:32,12; 1:64,5 and 1:128,11). These results are similar to those obtained in tropical countries where Toxoplasmosis is prevalent."

WEINER, D. **Toxoplasmosis in Animals.** *J. Amer. Vet. Med. Ass.* 1958, Dec. 1, v. 133, No. 11, 546–50. [52 refs.]

A general review and discussion.

JONES, Frances E., EYLES, D. E., COLEMAN, Nell & GIBSON, C. L. **A Comparison of Methods for the Isolation of** *Toxoplasma* **from Suspected Hosts.** *Amer. J. Trop. Med. & Hyg.* 1958, Sept., v. 7, No. 5, 531–5.

As the result of experiments described the authors found that they did not obtain a higher recovery rate of toxoplasms by using cortisone or by multiple animal passage. Infection by mouth or intracerebrally was not as reliable as the intraperitoneal route, and the rabbit had no advantage over the mouse. It is recommended that 4 mice be inoculated intraperitoneally with suspect

material, and that one mouse be sacrificed at 1 and a second at 2 weeks; also any animal dying is examined. The remaining mice are kept until 6 or 8 weeks, when a dye test is performed on their serum. A high titre is strongly suggestive of toxoplasmosis and the diagnosis is generally supported by the finding of pseudocysts in the brain. *I. A. B. Cathie*

HULDT, G. **The Dye Test and Complement-Fixation Test in Toxoplasmosis. A Comparative Investigation.** *Acta Path. et Microb. Scandinavica.* 1958, v. 43, No. 2, 141–56, 4 figs. [21 refs.]

The dye test and the complement-fixation reaction were applied to a series of sera obtained from the following groups of people in Sweden: (1) patients with acquired toxoplasmosis, including 13 mothers of congenitally infected infants and 23 patients with symptoms resembling infectious mononucleosis; (2) 8 patients with congenital toxoplasmosis; and (3) 4,817 suspected cases for screening.

The complement-fixation reaction usually became positive later and disappeared earlier than the dye test, the titre of the former generally falling within 2 months in contrast to the dye test which persisted in high titre for 6 months or more. In 8 congenital cases both tests were positive at much the same titre in mother and child though there were minor variations; in a follow up, however, the infant's sera often showed a decline in the complement-fixation reaction.

The large series of sera showed a negative reaction in both tests in 66%; among the sera giving positive reactions 85% had relatively low titres (the dye test not exceeding 1 in 250 and the complement-fixation reaction 1 in 60).

In an interesting discussion, the author points out that a rising titre indicates the presence of a fresh infection, persistently high titres indicate living *Toxoplasma* in proliferative colonies, cysts, or "toxoplasmin depots", and falling titres suggest subsiding infections. A high complement-fixation reaction suggests activity of the disease. Clinical symptoms cannot be ascribed definitely to infection with *Toxoplasma* unless the organism is isolated, and in 12 cases biopsy material revealed the organism. Women should be advised against pregnancy if rising titres are observed. *P. C. C. Garnham*

LUNDE, M. N. & JACOBS, L. **A Comparison of Results of Hemagglutination and Dye Tests for Toxoplasmosis in a Survey of Trinidad Natives.** *Amer. J. Trop. Med. & Hyg.* 1958, Sept., v. 7, No. 5, 523–5. [17 refs.]

In this survey of toxoplasm antibodies in the serum of West Indians a dye test was used in which the parasites had been washed in 10% serum in Hanks solution to remove any soluble antigens from the peritoneal fluid [this *Bulletin*, 1955, v. 52, 400]. The antigens for the haemagglutination test [*ibid.*, 1957, v. 54, 1463, 1464], which were pooled lysates of toxoplasms, had been diluted so that with a known positive serum they gave the same titre as the dye test. In 121 sera tested there was close agreement with regard to both positivity and titre. There was the usual rising incidence of antibodies with increasing age,

and over the age of 50 both tests were positive in 90% of sera examined. Even in the first 10 years of life 28·6% of the sera gave positive results, an unexpectedly high figure. *I. A. B. Cathie*

DERMATOLOGY AND FUNGUS DISEASES

TONG, J. L., VALENTINE, Eleanor H., DURRANCE, J. R., WILSON, G. M. & FISCHER, D. A. **Pulmonary Infection with** *Allescheria boydii*. **Report of a Fatal Case.** *Amer. Rev. Tuberculosis.* 1958, Oct., v. 78, No. 4, 604–9, 3 figs.

The repeated isolation of *Allescheria boydii* (*Monosporium apiospermum*) from the sputum of an individual with a pulmonary condition was recorded in France by DROUHET (*Therapy of Fungus Diseases*, p. 43. 1955. Boston: Little, Brown & Co.) and in the United States by CREITZ and HARRIS [this *Bulletin*, 1955, v. 52, 579]. The present article deals with the subsequent history of the latter case. From the sputum of a 56-year-old Spanish-American farmer previously treated for tuberculosis and suppurative pneumonia *A. boydii* was isolated on 12 consecutive occasions. On no occasion were acid-fast bacilli demonstrated in smears or cultured. Treatment with chloramphenicol gave some temporary improvement and sputum cultures were negative for 10 days, after which *A. boydii* was again isolated. At this stage the fungus which had originally been sensitive to the antibiotic *in vitro* was found to have become resistant.

The patient's condition continued to deteriorate and a right upper and middle lobectomy was performed, but he died 3 weeks later. Although satisfactory cultures were not obtained from the resected lung tissue clumps of mycelium were seen in sections of the necrotic lining and wall of an abscess cavity. At necropsy fluid obtained from a 5 cm. cavity in the apex of the left lung yielded a culture of *A. boydii* and the fungus was seen in a direct microscopic examination of this fluid.

The gross and microscopic pathology of the lungs are described. No other aetiological agent was found. *Jacqueline Walker*

HEAT STROKE AND ALLIED CONDITIONS

MALHOTRA, M. S. **Salt Requirements in the Tropics during Summer.** [Correspondence.] *Nature.* 1958, Oct. 11, v. 182, 1036.

In an environmental temperature of about 101°F. and relative humidity 54%, acclimatized subjects sweating 3–5 litres a day could be kept in salt balance on 6·2 gm./day. However, with a maximum temperature of 110°F. even acclimatized persons working 8 hours a day required 15 gm./day. This verified previous observations that salt deficiency did not occur in Indian Naval

personnel receiving 15 gm./day. Similarly textile workers were free from salt deficiency on this intake at 86°F. effective temperature.

It is concluded that 15 gm./day is quite adequate for acclimatized manual workers, and 6 gm. for sedentary workers in the tropics. *M. L. Thomson*

DRIVER, Audrey F. M. **Physiological Characteristics in relation to Climatic Preference.** *J. Applied Physiol.* 1958, Nov., v. 13, No. 3, 430–34, 1 fig. [21 refs.]

"An investigation of eight selected Chinese males showed that those who preferred the tropical summer of Hong Kong had higher blood pressures in both seasons than those who preferred the cool winter. The summer difference was statistically significant. No differences in change with season were observed between the basal metabolic rates, metabolic rates of the subjects sitting, or oral temperatures of the two groups. Statistical evaluation showed no difference in change in B.M.R. nor was any real difference found between the mean oral temperatures. The amount of unevaporated sweat produced during exercise was related to weight and not to climatic preference."

PEPLER, R. D. **Warmth and Performance: an Investigation in the Tropics.** *Ergonomics.* London. 1958, Nov., v. 2, No. 1, 63–88, 10 figs. [11 refs.]

This paper reports work which largely confirms wartime research of MACKWORTH and his colleagues at Cambridge, England [this *Bulletin*, 1946, v. 43, 1071; *Brit. J. Psychol.*, 1947, v. 39, 90; *Quart. J. Exper. Psychol.*, 1948, v. 1, 6; *Med. Res. Council Spec. Rep. Ser. No. 268*, 1950]. Young servicemen who had been naturally acclimatized to the Singapore climate for at least 6 months were subjected in random manner to the following controlled dry and wet bulb temperatures: 75°/65°, 85°/75°, 93°/83° and 100°/90°F., with air movement 80 ft./min. During the exposure, tests of (1) manual tracking ability (pursuit-meter), (2) visual watch-keeping, and (3) high-speed decision-taking [see below] were carried out.

Generally, performance first began to deteriorate at 81–86°F. effective temperature. The changes in skilled performance and body temperature were not directly related. In (1) humid climates appeared to cause deterioration at a lower temperature than dry. Incentives did not affect the deterioration significantly. *M. L. Thomson*

CHILES, W. D. **Effects of Elevated Temperatures on Performance of a Complex Mental Task.** *Ergonomics.* London. 1958, Nov., v. 2, No. 1 89–96, 2 figs.

An investigation by PEPLER (*Applied Psychology Research Unit* Report No. APU 196/53, 1953) had shown that departure from the thermal comfort zone had an adverse effect on performance of a complex mental task (the high speed, decision-taking task of Pepler [see above]). In this test the subject had to compare each of 20 moving cards with each of 10 stationary ones. The cards had six symbols so that there were 6 possible differences and a decision

had to be taken on an average every 5·4 seconds, for a total period of 18 minutes.

In view of its importance this work was repeated in Dayton, Ohio, by means of the same trial routine and, in the first experiment, the same four thermal conditions as in the above paper. In a second experiment a higher range of temperature was adopted, extending up to an intolerable 109°F. effective temperature at which only 3 out of 5 subjects were able to complete the test.

In both experiments temperature had no effect on performance. Minor differences in the actual test are quoted as a possible explanation for this complete disagreement with the English results.

[It is possible that previous exposure to Dayton summer weather caused significant acclimatization to heat.] *M. L. Thomson*

YEN, Ho-Ch'ang, LU, Hsing-Hua, YUAN, Ping-Hsün, WU, Hsieh-Ning & T'ANG, Hsiao-Chün. **Chlorpromazine and Heat Reducing Measures in Treatment of Heat Stroke.** *Chinese Med. J.* Peking. 1958, Aug., v. 77, No. 2, 174–7.

Chlorpromazine produces hypothermia by central and peripheral actions. It depresses the thermoregulating nucleus in the hypothalamus, preventing reactions, such as shivering, to the externally applied cooling measures. The drug also produces vasodilatation, increasing the efficiency of treatment.

Chlorpromazine (25 mgm. in 300 ml. saline) was administered intravenously during 20 minutes to 15 of 20 subjects with heat stroke in Shanghai at ambient temperature of 37°C. All but 1 of the 15 patients recovered with rapid fall of body temperature, even where coma and convulsions had supervened. Of the remaining 5 patients, 3 died in spite of standard temperature-reducing treatment. The 3 deaths all occurred, however, within a few hours of admission.

Of the 20 patients, 14 were above 60 years of age and 17 were women, of whom 3 had recently given birth. *M. L. Thomson*

MISCELLANEOUS DISEASES

VON HOLT, C. & LEPPLA, W. Die Konstitution von Hypoglycin A und B. [**The Chemical Constitution of Hypoglycin A and B**] *Hoppe-Seyler's Ztschr. f. physiol. Chem.* 1958, v. 313, 276–90, 9 figs. [16 refs.]

The English summary appended to the paper is as follows:—

"1. The isolation from unripe fruits of *Blighia sapida* of two blood-sugar depressing substances, Hypoglycin A and Hypoglycin B, is described.

"2. Hypoglycin A is a β-[methylene-cyclopropyl]-L-α-amino-propionic acid.

"3. Hypoglycin B is a dipeptide of Hypoglycin A with glutamic acid."

[See this *Bulletin*, 1958, v. 55, 1050.]

D'Abrera, V. St. E. **The Aetiology of "Tropical Eosinophilia", with a Preliminary Note on the Pathology of the Syndrome.** *Ceylon Med. J.* (n.s.) 1958, May, v. 4, No. 3, 195–210, 8 pls. [28 refs.]

The author recalls his view that this disease develops through three phases—coryzal, bronchitic, and asthmatic, and after some review of the literature quotes 3 cases detected in the coryzal stage and successfully treated with carbarsone. In one case it was clear that the syndrome developed during the early stage of an *Ascaris* infection. Three cases associated with lymphadenopathy are also recorded. Regarding aetiology, mites in the bronchioles, and microfilariae, are admitted to be possible causes but their importance is not thought to be great.

By analogy with *Toxocara canis* infections, and because tropical eosinophilia often responds to Hetrazan [diethylcarbamazine], the larvae of other nematodes were considered to be likely causes. The author obtained post-mortem material from 4 adults diagnosed as having tropical eosinophilia, and in all 4 found granulomata confined to the respiratory bronchioles and alveolar ducts. In one case chitinous material was found in the granulomata, and a search of 350 sections revealed a disintegrating larval nematode identified as *Necator americanus*, in one granuloma. 5 photomicrographs, very indifferently printed, illustrate this finding. The lesion is described as a necrotizing bronchiolitis around the dead larva, the congested stagnant capillaries allowing the escape of eosinophils and red blood cells; the latter may stain the sputum, but are also taken up and appear as haemosiderin in the numerous macrophages which fill the contiguous alveoli and account for the radiological shadows. The paper ends with a discussion of the subject, at some length.

If a change in the nomenclature be considered, the author suggests "Parasitic Bronchiolitis". [This term has the great merit of precision, but for that very reason will be difficult to apply with certainty, and is unlikely to describe every case now regarded as tropical eosinophilia; nor does it recognize the allergic element in the clinical syndrome.] *Alan B. Raper*

Parekh, J. G., Kulkarni, V. B. & Patel, B., with the technical assistance of S. V. Sampath. **Diethylcarbamazine in Tropical Eosinophilia.** *J. of J.J. Group Hosps. & Grant Med. College.* Bombay. 1958, Oct., v. 3, No. 4, 271–80, 6 figs. [12 refs.]

This paper presents the results of clinical trial of diethylcarbamazine in tropical eosinophila in 92 patients in Bombay—the first 50 with oral and the next 42 with injectable diethylcarbamazine citrate. By mouth the usual dose was 450 mgm. daily (9 to 10 mgm./kgm.) in three divided doses for 3–7 days. In the second series the drug was given by intramuscular injection of 1 ml. (400 mgm. per ml.) daily for 2 consecutive days with the addition of an antihistamine.

At the first follow-up, between the fourth and seventh days with oral treatment there was a mean fall of eosinophils of 39·6% and with the parenteral treatment a mean fall of 64%. The overall incidence of patients who were benefited came to 95–97%. The drug did not produce any toxic reactions in most patients, except minor effects such as drowsiness or giddiness.

The dosage of 9–10 mgm./kgm. body weight per day in 3 divided doses by oral therapy and 8 mgm./kgm. body weight by injection per day, 2 of such injections being given on consecutive days, has been adopted.

Diethylcarbamazine should be considered as the drug of choice in the treatment of tropical eosinophilia [see also this *Bulletin*, 1958, v. 55, 920, 1051].

Philip Manson-Bahr

EARLE, K. V. **Ainhum of the Fingers: a Case from Sierra Leone.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1958, Nov., v. 52, No. 6, 570–73, 2 figs.

Though ainhum of the toes is comparatively common, a similar condition of the fingers is rare. Most of the reported cases, sometimes referred to as " pseudo-ainhum ", have been complicated by the presence of leprosy.

The particular patient, photographs of whose hands illustrate this paper, was about 38, a member of the Koranko tribe, Sierra Leone. He presented ainhum of the right little finger, a condition which had become noticeable some 5 to 10 years previously. A constricting band had developed. The finger became displaced outwards and proximally, so as finally to lie in the position of adduction at right angles. Some 10 to 15 years previously, a similar process had taken place in the left ring finger, but finally auto-amputation had taken place. The condition is known in Koranko language as *kenke*. The skin over the distal half of the right fifth metacarpal was wrinkled and lighter in colour than the surrounding normal skin. Sensation was blunted. Under local anaesthesia the little finger was amputated. Radiological examination showed that the first phalanx was missing and the second phalanx was attenuated and that there was also decalcification.

Ainhum of the fingers can only be diagnosed with certainty when the patient is of Negro race or descent, when the condition is of chronic, long-drawn-out development in a finger previously regarded as normal, and when leprosy can be excluded.

Philip Manson-Bahr

EMAM, A. M. **Malignant Change in a Rhinoscleromatous Ulcer.** *J. Egyptian Med. Ass.* 1958, v. 41, Nos. 5–6, 310–15.

" The case is the first to be encountered showing a malignant change in a scleromatous lesion. Apart from the pathological interest, clinically, the possibility should be borne in mind in diagnosis, in judging the prognosis and in deciding the urgency for treatment and the type of therapy applied."

HUGHES, L. E. & PHILIP, C. B. **Experimental Tick Paralysis in Laboratory Animals and Native Montana Rodents.** *Proc. Soc. Exper. Biol. & Med.* 1958, Nov., v. 99, No. 2, 316–19.

Hamsters were found to become paralysed when bitten by F_1 adult progeny of *Dermacentor andersoni* from British Columbia which had produced the disease in dogs. No infectious agent could be demonstrated and no gross lesions were found in affected animals. Similar results were obtained by feeding pairs of ticks on marmots (*Marmota flaviventris*), ground squirrels

(*Citellus columbianus*), wood rats (*Neotoma cinerea*) and guineapigs, but not on white rats, rabbits and cats. Ticks from British Columbia gave a higher incidence than Montana ticks. Ticks partially fed on fatally affected hamsters produced the disease when they completed their feed on fresh hamsters. Male ticks alone failed to cause the disease. Many animals from which the ticks were removed early in the illness recovered. Affected hamsters showed hyperactivity followed by ataxia and flaccid paralysis. Respiratory failure preceded cardiac failure. The hamster is, in the authors' opinion, the experimental animal of choice for the study of tick paralysis. *C. E. Gordon Smith*

ENTOMOLOGY AND INSECTICIDES: GENERAL ZOOLOGY

[Papers on the toxic effects of insecticides in man are abstracted in the *Bulletin of Hygiene* under the general heading of Occupational Hygiene and Toxicology.]

HOUSE, H. L. **Nutritional Requirements of Insects associated with Animal Parasitism.** *Exper. Parasit.* New York. 1958, Nov., v. 7, No. 6, 555–609. [Numerous refs.]

TOSCHI, G. & BETTINI, S. Le proteine dei muscoli di insetti. Studio elettroforetico. [**The Protein Composition of Insect Muscles. An Electrophoretic Study**] *Rendiconti Istituto Superiore di Sanità.* Rome. 1958, v. 21, Pts. 7/8, 678–91, 3 figs. [25 refs.] English summary.

VAN SOMEREN, E. C. C., HEISCH, R. B. & FURLONG, M. **Observations on the Behaviour of some Mosquitos of the Kenya Coast.** *Bull. Entom. Res.* 1958, Dec., v. 49, Pt. 4, 643–60, 5 figs.

80 species, subspecies and varieties of mosquito were taken in studies from 1949 to 1952 in the coastal villages of Ganda and Mambrui and adjacent bush in Kenya. Catches were made by net in the bush, by space-spray and window-trap in houses, and by 24-hour catches on human bait. Ganda is 5 miles inland, and Mambrui is on the coast. The text and maps describe their characteristics, the people and their habits.

Only 19 of 65 species recorded from the bush by net catches were taken regularly and of these 5 (*Taeniorhynchus uniformis* and *T. africanus, Aëdes woodi, Culex invidiosus* and *C. guiarti*) were abundant. In village houses, *Culex pipiens fatigans* was abundant, *Aëdes aegypti* not uncommon, and *Anopheles gambiae* and *A. funestus* seasonal. Window-traps serving to catch mosquitoes entering a house caught few specimens, but 30 species were taken in exit-traps, of which 7 occurred regularly (*viz.*, both species of *Taeniorhynchus, C. p. fatigans, C. horridus, Aëdes aegypti, A. gambiae* and *A. funestus*).

Catching sites for 24-hour catches on human bait were in bush, compound and house. The catches were recorded for hourly intervals; one 24-hour catch was made generally monthly in each site from October 1949 to July 1951. Sufficiently large catches were obtained of 13 of the 35 species taken to enable

a biting cycle to be discerned. Only *A. gambiae, Aëdes aegypti* and *C. p. fatigans* were sufficiently numerous to allow comparison of biting cycle in the three situations; 7 other species were sufficient in numbers only in the bush. These were *T. africanus* and *T. uniformis, Aëdes fryeri, Aëdes metallicus, Aëdes albicosta, Culex antennatus* and *Anopheles squamosus*. There is to be a separate paper on *Culex sitiens*; possible error in earlier identifications of *Aëdes albocephalus* and *C. tritaeniorhynchus* preclude discussion of findings for them. The biting cycles for the above 10 species, and for *A. funestus* on one 24-hour catch, are shown graphically. Some points of interest in these biting cycles are as follows. There was some biting by night in all situations by the day-biting *Aëdes aegypti* and a high biting rate in the bush site in the evening. It is probable that catches in the house were of var. *queenslandensis* and in the bush of ssp. *formosus*. *A. gambiae* was more often biting outdoors than indoors with a night biting cycle similar to earlier findings by others [this *Bulletin*, 1950, v. 47, 304; 1955, v. 52, 893]. *C. p. fatigans* was mainly nocturnal and commoner indoors than in the compound or bush. The 7 species taken mainly in bush were in general biting by night with, for some, peaks of activity about dusk and dawn. *D. S. Bertram*

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BÜTTIKER, W. Sur la présence au Cambodge d'*Anopheles annandalei interruptus* Puri (1929). [**Presence of** *Anopheles annandalei interruptus* **in Cambodia**] [Miscellanea]. *Acta Tropica*. Basle. 1958, v. 15, No. 4, 356–7, 1 fig.

SENEVET, G. & ABONNENC, E. A propos de quelques *Culex* sud-américains. [**Some South American Species of** *Culex*] *Arch. Inst. Pasteur d'Algérie*. 1958, Sept., v. 36, No. 3, 343–50, 3 figs.

HUDSON, Anne, MCKIEL, J. A., WEST, A. S. & BOURNE, T. K. R. **Reactions to Mosquito Bites.** *Mosquito News*. 1958, Sept., v. 18, No. 3, 249–52, 2 figs.

Rabbits were used in this study and two main methods of inducing sensitivity to the bites of *Aëdes aegypti* were employed. In the first method rabbits were exposed to large numbers of mosquitoes daily for 5 days; sensitization by this method gave unpredictable results. In the second method two bites daily were given and the bitten area examined for a reaction; in this method weal formation occurred 7 to 9 days after the start of the trial, maximum-sized weals occurring between 10 and 14 days after the test bites. In a modification of this method paired bites were given on alternate days but gave reduced sensitivity.

In mosquitoes of other species some cross-sensitivity was found but this was thought to be dependent upon the time interval since sensitization. At the point of maximum sensitization specificity of the reaction was most marked, whereas after an interval this specificity diminished.

Chromatographic studies of whole mosquito extracts indicate that the active sensitizing material has at least four components, of which 0·0013 μgm. was calculated sufficient to produce a reaction. *E. R. Nye*

ELMORE, C. M., Jr. & FAY, R. W. *Aedes sollicitans* **and** *A. taeniorhynchus* **Larval Emergence from Sod Samples.** *Mosquito News.* 1958, Sept., v .18, No. 3, 230–33.

From a salt marsh area near Elba Island, Georgia, 108 sod samples of comparable size were collected and divided into three groups. These groups were kept at 60°, 70° and 80°F. respectively. Interval flooding of samples was carried out for 12 days and larval counts made; after a 10-day break further flooding of the samples and larval counts were made. Counts of larvae from two hatching periods could thus be compared.

From their results the authors found that estimates of the production potential of *Aëdes sollicitans* and *A. taeniorhynchus* were influenced by pre-flood temperatures and counts and identifications based on a particular stage of the life history. Thus counts based on 1st instar larvae, 4th instar larvae and emerging adults gave varying results for the relative numbers of the two species. Other factors were uneven distribution of eggs in sod samples, ranging from 14 to 1,444 per 0·2 sq. ft., and the season at which sampling was carried out. *E. R. Nye*

VAN DEN ASSEM, J. *Mansonia* (*Mansonioides*) *bonne-wepsterae,* **spec. nov. (Culicidae), with Notes on Habits and Breeding Place.** *Trop. & Geograph. Med.* Amsterdam. 1958, Sept., v. 10, No. 3, 205–12, 4 figs.

The male, female, larva and pupa are described of a new species of *Mansonioides* related to *M. longipalpis* (= *dives*), which is widespread in New Guinea, and feeds on man. The larvae are found attached to the roots of *Pistia* and *Hydrocharis* in water polluted by organic material. A water analysis is given of the breeding place. Larvae of *Ficalbia modesta* (equally common) and *M. uniformis* (outnumbered by about 10 to 1) were also found attached to the roots of these plants. The new species was identified as *M. longipalpis* by VAN DIJK [this *Bulletin,* 1958, v. 55, 1260]. *B. R. Laurence*

See also p. 469, LAURENCE & SMITH, **The Breeding of** *Taeniorhynchus* **(Subgenus** *Mansonioides***) Mosquitoes in the Laboratory.**

ABONNENC, E. Morphologie de *Phlebotomus antennatus* Newstead, 1912 et de *Phlebotomus dubius* Parrot, Mornet et Cadenat, 1945, d'après des individus d'élevage. [**Morphology of** *Phlebotomus antennatus* **and** *Phlebotomus dubius,* **reared in the Laboratory**] *Arch. Inst. Pasteur d'Algérie.* 1958, Sept., v. 36, No. 3, 314–26, 6 figs.

ABONNENC, E. Sur *Phlebotomus simillimus* Newstead, 1914 et ses variétés. [*Phlebotomus simillimus* **and Its Varieties**] *Arch. Inst. Pasteur d'Algérie.* 1958, Sept., v. 36, No. 3, 327–38, 5 figs. [10 refs.]

PARROT, L. & CLASTRIER, J. Notes sur les phlébotomes. LXXII.—Présence à Biskra (Algérie) de *Phlebotomus lewisi* Parr., 1948. [**Notes on** *Phlebotomus*. **LXXII. Presence of** *P. lewisi* **at Biskra, Algeria**] *Arch. Inst. Pasteur d'Algérie*. 1958, Sept., v. 36, No. 3, 312–3.

ABONNENC, E. & HAMON, J. Sur un phlébotome nouveau de la Côte d'Ivoire *Phlebotomus moreli*. [**A New** *Phlebotomus* **from the Ivory Coast,** *P. moreli*] *Arch. Inst. Pasteur d'Algérie*. 1958, Sept., v. 36, No. 3, 339–42, 2 figs.

GERSDORFF, W. A. & PIQUETT, P. G. **Relative Toxicity and Intensity of Synergism of Mixtures of Piperonyl Butoxide with the** *cis* **Isomers of Allethrin as House Fly Sprays.** *J. Econom. Entom.* 1958, Oct., v. 51, No. 5, 675–8.

"When applied to house flies, *Musca domestica* L., in 10:1 proportion as space sprays on the Campbell turntable, mixtures of piperonyl butoxide with *l*-allethrolone *d-cis*-chrysanthemumic acid ester, the *d-l, l-l,* and *d-d* esters, *d-l-cis* allethrin, and allethrin itself were, respectively, 0·842, 0·341, 0·074, 3·86, 1·55, and 3·12 times as toxic as allethrin alone. Synergism was demonstrated in all mixtures. Its intensity ratio was about 2·63 at the 50% mortality level for those containing the *l-d* and *d-l* esters and *cis*-allethrin, 2·17 for that containing the *d-d* ester, and 3·69 for that containing the *l-l* ester. The intensity ratios were one-fourth less at the 5% and about one-third more at the 95% mortality level. The synergized ester mixtures retained high knockdown value. Insecticidal stability of the *l-d* and *d-d* esters in 2% kerosene solutions during 20 months' storage was demonstrated."

LABRECQUE, G. C., WILSON, H. G. & GAHAN, J. B. **Resistance of House Flies in Florida to Organophosphorus Insecticides.** *J. Econom. Entom.* 1958, Oct., v. 51, No. 5, 616–17.

"Based on the LC-50's in tests with contact sprays, house flies (*Musca domestica* L.) collected in eight dairies and six poultry houses in Florida in 1957 were 3 to 133 times as resistant as normal flies to malathion, 11 of the strains were 1·3 to 72 times as resistant to Dipterex, five strains were 5 to 38 times as resistant to Diazinon, and seven were 3 to > 18 times as resistant to parathion. In tests with poisoned baits, 10 strains were 13 to > 105 times as resistant as normal flies to malathion, and four of these strains were 3 to 19 times as resistant to Dipterex; in 1954 and 1956 the resistance to Dipterex or malathion baits did not exceed 8 times normal in flies from the barns where these four strains were collected."

MACLEOD, J. & DONNELLY, J. **Local Distribution and Dispersal Paths of Blowflies in Hill Country.** *J. Animal Ecology*. 1958, Nov., v. 27, No. 2, 349–74, 1 pl. & 4 figs.

[See this *Bulletin*, 1958, v. 55, 109.]

WALTON, G. A. **Notes on *Argas brumpti* Neumann 1907 (Argasidae Ixodoidea) in Kenya and Tanganyika.** *East African Med. J.* 1958, Oct., v. 35, No. 10, 569–72, 1 chart.

Adults and juveniles of *Argas brumpti* have been found beneath slabs of rock, lying around rocky outcrops in various parts of Kenya and Tanganyika [see also this *Bulletin,* 1950, v. 47, 1043]. Blood samples taken from the ticks could not be identified. Under one stone, where ticks were living, the temperature was 102°F. and the relative humidity 20%. Females of this species have been kept alive for nearly 10 years.

Three specimens were fed on a monkey (*Cercopithecus*), which developed a high temperature and extensive subcutaneous haemorrhages the next day. Short rod-shaped organisms, tentatively identified clinically as belonging to the *Listeria* group, were numerous in the blood for 14 days, but became less numerous when the haemorrhages cleared. Nodules were formed at the site of the bites, and one excised on the 10th day contained many rod-shaped organisms. In this part of Africa the local Watharaka tribe associate the bites of *Argas* with ulceration and sickness. *B. R. Laurence*

HARRIS, W. V. & BROWN, E. S. **The Termites of the Solomon Islands.** *Bull. Entom. Res.* 1958, Dec., v. 49, Pt. 4, 737–50, 14 text figs. & 8 figs. on 2 pls. [16 refs.]

"Twelve species of termites occurring in the British Solomon Islands Protectorate are listed, and an illustrated key to their soldier castes is provided. An analysis of the 114 records has been made in order to indicate, in a general way, the relative abundance of the various species. Notes are given on distribution within the islands, on habitats and nests, and on the occurrence of termites on coconut palms and in buildings. Damage to buildings is discussed and suggestions made for control measures applicable to local conditions."

WORLD HEALTH ORGANIZATION. TECHNICAL REPORT SER. NO. 153. **Insect Resistance and Vector Control. Eighth Report of the Expert Committee on Insecticides, Geneva, 18–23 November 1957.** 67 pp., 3 figs. 1958. Geneva: Palais des Nations. [Sales agent for U.K., H.M. Stationery Office.] [3s. 6d.; $0.60; Sw.fr. 2.–.]

In the introduction the Expert Committee on Insecticides recommends to the parent body, the World Health Organization, that it participate in the encouragement and coordination of research and publication on the ecology of disease vectors, viewing this field imperative to a fundamental appreciation of problems of resistance and residual foci of vectors which occur and will do so increasingly with intensification of vector control by chemicals.

The report includes in annexes full details of tests, with standard kit, for the resistance of adult and of larval mosquitoes to insecticides. A standard kit is also available for testing lice. Preliminary trials are being made of methods suitable for other insect vectors of disease. A bioassay method for determining the insecticidal activity of a treated surface has been developed and is fully described and illustrated.

The major part of the report comprises recommended methods for pest and vector control. An introduction to this section discusses general points and then follows a series of sections setting out with practical details methods for controlling with chemicals the following arthropods: house-fly, tsetse fly, simuliids, *Phlebotomus,* anopheline and culicine mosquitoes, body lice, head and crab lice, fleas, bed bugs, triatomid bugs, cockroaches, argasid and ixodid ticks, and trombiculids. In appropriate instances repellents are also dealt with. No attempt is made to deal with all species of vector, although important species with particular control problems are often considered in some detail. There is a considerable extract from the recommendations of the Sixth Report of the WHO Expert Committee on Malaria [this *Bulletin,* 1958, v. 55, 248] to cover the principles of control for the anopheline adults. Rodent control is also dealt with.

There are useful sections on the toxicity of insecticides to man and on precautions to minimize risks of toxic effects. Finally, there are several tables and other matter to assist in the preparation of formulations of insecticides and in determining rates of their application.

This publication is undoubtedly a most instructive handbook for the field worker and others concerned with the practice and problems of controlling arthropod pests and vectors of diseases to man. It is particularly satisfying to note that it will be kept up-to-date by revision every two years.

[For the Seventh Report, see this *Bulletin,* 1957, v. 54, 1477.]

D. S. Bertram

MISCELLANEOUS PAPERS

MANSON-BAHR, P. **The March of Tropical Medicine during the last Fifty Years (Footprints on the Sands of Time).** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1958, Nov., v. 52, No. 6, 483–99, 2 graphs.

Sir Patrick Manson, the "Father of Tropical Medicine", was the first president of the Royal Society of Tropical Medicine and Hygiene, and it was in every way fitting that the first of the Manson Orations, recently instituted by this society, should be delivered by his disciple and son-in-law, Sir Philip MANSON-BAHR, himself a Past-President.

Sir Philip developed his subject by giving an account of his own varied experiences during the 50 years in question. His first excursion was to Fiji in 1909, where he was principally concerned in the study of filariasis and dysentery, but had time to devote to other subjects such as leprosy. Returning to the island 40 years later, he found that the incidence of filariasis had markedly decreased as the result of an efficient anti-mosquito service, and that DDT and sulphaguanidine in their differing ways had made bacillary dysentery a disease of minor importance. A visit to Ceylon in 1912 to investigate sprue was disappointing in its results, though it afforded an opportunity to make a pictorial study of the mouth lesions in that disease. The 1914–18 war saw him in Gallipoli, Egypt and Palestine, engaged in the study of dysentery,

malaria and schistosomiasis. He was responsible for the establishment of malaria diagnosis units which facilitated the early treatment of this devastating disease. He reached Cairo just after the departure of LEIPER, who had worked out the life cycle of the Egyptian schistosomes, and had contacts with Hamilton FAIRLEY, who recognized and described the symptoms which follow a heavy invasion with cercariae, and subsequently devised a skin test and a complement-fixation test for the diagnosis of this infection. He found pellagra rife among refugees and prisoners of war: at this time its aetiology was obscure and there was no satisfactory treatment. He made brief acquaintance with cholera in an outbreak of some 30 cases with 6 deaths.

Up to this point, although much had been done in rendering diagnosis more definite and more reliable, little progress had been made in treatment. Advances in chemotherapy began to appear shortly after the end of the war. Bayer 205 revolutionized the treatment of trypanosomiasis, both in human beings and domestic animals. Plasmoquine and atebrin greatly advanced the treatment of malaria, and the use of atebrin instead of quinine put an end to blackwater fever. Sulphonamides for the treatment of various bacterial infections, sulphones for leprosy, nicotinic acid for pellagra, and folic acid for certain types of sprue are but a few of the discoveries which followed in subsequent years. In the investigation of all these remedies Sir Philip was ever in the vanguard.

This Odyssey, illustrated by a wealth of anecdote, is one that cannot be summarized, and must be read in the original. It breathes the vitality of its author, who justly claims that the road he has traversed has been for him the high road to happiness. *J. S. K. Boyd*

DEAN, N. M. B. **The Health Problems of the Pre-School Child in Africa and the Role of the Public Health Nurse in their Solution.** *J. Trop. Pediatrics.* London. 1958, Dec., v. 4, No. 3, 112–21, 1 fig.

This paper lists the chief complaints in 200 pre-school children in Nigeria. It is a large and varied list, but most of the diseases can respond to simple remedies and many are preventable. Child health requires an integrated service, which is at least as important as schemes for specific diseases such as yaws, leprosy or tuberculosis. Doctors, laboratory technicians, voluntary workers and health educationists are needed. The public health nurse has an essential role, for she alone sees the child in the home environment. Perhaps her most important task is helping to teach the mother how to feed her child better. *R. Passmore*

REPORTS AND SURVEYS

EAST AFRICA HIGH COMMISSION. **East African Trypanosomiasis Research Organization, Tororo. Report No. 8, 1956–57** [LUMSDEN, W. H. R., Director]. pp. ii + 81, 14 figs. (8 on 4 pls.) 1958. Nairobi: Govt. Printer. [Sh. 7/50.]

This report differs from last year's [see this *Bulletin,* 1957, v. 54, 1261] in that it covers a period of 18 months, and in that accounts of individual investigations appear under the names of the workers responsible rather than a general report on the year's work by the chiefs of the various sections. It is believed that this mode of presentation will enhance the value of the report as a scientific document and will encourage contacts. After a short introduction the matter is reported under five main heads—human trypanosomiasis, animal trypanosomiasis, protozoology, entomology and miscellaneous.

In the human trypanosomiasis section *Glossina pallidipes* is incriminated as probably the main vector of *Trypanosoma rhodesiense* in south-east Uganda, with *G. palpalis* playing a minor role. Investigations were made into hepatic dysfunction during infection, serum protein levels in early and late infections, and into the toxic reactions of Mel B which are believed to result from sensitization to the drug. Investigation of a strain of *T. rhodesiense* isolated from a patient relapsing after two courses of treatment with Mel B showed that the relapses were not due to drug resistance and that repeated treatment with Mel B was justified. A small hospital has been opened at EATRO headquarters for the study of cases of human trypanosomiasis, most of which came from an epidemic in south-east Uganda already reported [see *ibid.,* 1958, v. 55, 1306].

Haematological base lines have been established for Zebu cattle and a similar study is being made on Ankole Longhorns. A relatively simple technique has been developed for the estimation of trypanosome challenge. It was confirmed that chemoprophylaxis combined with injection of trypanosomes conferred a prolonged resistance to infection.

Much interesting work is reported in the protozoology section. Deep freezing has preserved strains of trypanosomes satisfactorily for periods up to 45 weeks without any notable change in the characteristics of the strain. Investigation of the colloidal gum mastic reaction in diagnosis showed that this test is unlikely to be useful in the field. The early development of inoculated parasites [see *ibid.,* 1958, v. 55, 636] continues to be studied. Infection of man by the Tinde strain of *T. rhodesiense,* fly-maintained in sheep since 1934, was tested; syringe passage was successful but fly passage failed, possibly because of scanty trypanosomes in the saliva. After 20 years' syringe passage in mice this strain has become monomorphic and no longer infective to *G. morsitans*; mice, after recovery, show resistance to reinfection with it. Changes in trypanosome morphology are associated with remissions and relapses; stumpy forms increase as parasitaemia decreases while cortisone increases the proportion of slender forms. Attempts to show that circulating antibody caused the increase in stumpy forms were not successful.

Entomological research showed that fly-round figures gave an unsatisfactory estimate of the trypanosome challenge and that no suitable method had been devised for estimating fly populations. The resting places of *Glossina* were studied by treating captured fly with fluorescing paints, releasing them and then

searching for them with ultra-violet light. They appear to rest on the boles of trees and the undersides of leaves during the day and mainly on the tops of leaves at night. Investigations are reported concerning the antennal sense organ, the water and non-fat reserves in fly and the consumption of fat by pupae. Factors involved in reproduction are being studied and some information of practical value has been acquired.

The new form of presentation of the report is attractive. Many important advances in knowledge concerning the parasite and the fly are reported. It has been impossible to do more than indicate the main subjects dealt with and the report should be read by all interested in problems of trypanosomiasis.

T. H. Davey

CORNAND, G. Aoulef et le Tidikelt occidental. Étude historique, géographique et médicale. [**Historical, Geographical and Medical Study of Aoulef and Western Tidikelt**] *Arch. Inst. Pasteur d'Algérie.* 1958, Sept., v. 36, No. 3, 370–406, 6 text figs. & 26 figs. on 12 pls. [25 refs.]

The present paper adds to the growing series of studies of the ecology of the populations of Saharan oases [see this *Bulletin,* 1958, v. 55, 1182 for earlier references]. Aoulef is far in the Sahara, south of the Atlas mountains, where artesian and surface water has from prehistoric times sufficed to support a small population of mixed races which have drifted in at one time or another from north or south and which now number slightly over 8,000. Rainfall is very slight, considerably under 1 inch a year; temperatures are extreme, ranging from a mean minimum of 6°C. (44°F.) in winter to a mean maximum of 45°C. (113°F.) in the summer; and ground water supports numerous date palms and less prolific corn crops and fruit trees. Flies are innumerable, and sanitary ideas are primitive but a population has survived certainly since palaeolithic times.

A detailed statement of diseases classifies them as carried by vectors, otherwise transmissible, and non-transmissible, and gives the prevalence and nature of common conditions under each head. Infections of the eye and particularly trachoma clearly dominate the entire medical picture. On one survey 91% of people examined were found to have trachoma and 1·9% were suspected. "Every inhabitant either has had, has, or will have trachoma." Bacillary conjunctivitis is also common, gonococcal conjunctivitis less so, and ulcers of the cornea, glaucoma, iritis and keratitis are everyday affairs in the dispensary. In the past, epidemics of smallpox, typhus, measles and whooping cough have probably taken second place in importance to eye conditions, while varicella, mumps and diphtheria have been less common, and, curiously, epidemics of typhoid and paratyphoid have been rare and dysenteries and cholera unknown. Tuberculosis too is not excessive: the Mantoux positive rate is 42·5%. Malaria is discussed at some length but was relatively uncommon, cases being occasional; it was due to *Plasmodium vivax* and *P. falciparum* and apparently carried by *Anopheles multicolor,* the sole local anopheline. Leishmaniasis has been suspected but not confirmed on one occasion, exanthematic typhus has been epidemic, but other insect-borne diseases are not known. Among non-transmissible diseases, asthma is perhaps the most important, dyspepsias and gastritis are common, hypertension and circulatory conditions are rare. Neoplasms are certainly rare, only two have been recorded and a survey was negative. Despite

the extreme inhospitality of the Sahara, its oases support a population which survives in sufficient numbers to be a source of emigration and potential population problems. *G. Macdonald*

WOLFF, H. L. **Report on a Journey through Tropical Africa, sponsored by the World Health Organization.** *Acta Leidensia (Scholae Med. Tropicae).* 1958, v. 28, 136–53.

BOOK REVIEWS

COCHRANE, R. G. [M.D., Ch.B., F.R.C.P., D.T.M. & H.] [Edited by.] **Leprosy in Theory and Practice.** With a foreword by Sir George McROBERT, C.I.E., M.D., F.R.C.P. pp. xv + 407, frontispiece & 189 figs. 1959. Bristol 4: John Wright & Sons Ltd., The Stonebridge Press, Bath Road. [84s.]

Considerable advance has been made in our knowledge of leprosy since Dr. R. G. Cochrane published his former major work on leprosy in 1947 [this *Bulletin,* 1947, v. 44, 1026]. Following on the hopeful results obtained with the treatment of leprosy with sulphones, a large number of workers in other fields—pathologists, bacteriologists, neurologists, surgeons and other specialists—have taken an interest in leprosy and have already obtained valuable results. Dr. Cochrane is responsible more than anyone else for this spread of interest. He has now gained the assistance of several of this band of workers in compiling this volume, which within its 400 pages has collected a vast amount of valuable, up-to-date, practical knowledge.

The book consists of 25 chapters and 10 appendices. Of these, 11 chapters and 3 appendices are written by the editor, while 23 other authors contribute on aspects in which they have made special studies. The 189 illustrations are excellent; a few of them are in colour.

It is impossible in a short review to assess the various themes which compose this book, and it would be invidious to single out any particular author or subject for special mention. The history is adequately reviewed by the editor in the first chapter. The following 4 chapters discuss bacteriology including a review of other pathogenic and saprophytic mycobacteria. In the seventh and eighth chapters there is an account of recent work on the pathology of leprosy with special reference to neurology. Then the editor contributes 4 chapters on immunology, signs and symptoms, differential diagnosis, and classification. An ophthalmologist gives an adequate and well illustrated review of leprous conditions of the eye and their treatment, and the editor writes 2 more chapters on ear, nose and throat conditions and on lepra reaction.

After a chapter on the sulphones from the biochemical viewpoint, the editor writes 2 chapters on the therapy of leprosy and the control of lepra reaction. This is followed by a chapter with 2 parts: one dealing with new forms of treatment tested in patients, and the other with the assessment of anti-leprosy drugs in rat leprosy.

The next 4 chapters deal with the deforming and disabling complications of leprosy, being respectively on radiology, deformity, care of the feet and physiotherapy. In the last 2 chapters the editor writes on prognosis and prevention.

The 10 appendices are sure to prove of much value. They deal in a practical way with plastic surgery; examination of the patient; the bacterial index; the method of concentrating bacilli in biopsy material; cutting sections; staining by silver impregnation; recording lesions on diagrams and intradermal injections by means of numbers; the lepromin test; and lastly an account is given of a method of leprosy control in south-west Tanganyika.

This book is likely to remain for long the standard work on leprosy. It brings together an exhaustive collection of technical detail from clinical, laboratory and field work. It should be studied carefully by those interested in the treatment and relief of leprosy, and in planning the control of the disease. It will also be of interest to those who study mycobacteria, to neurologists and ophthalmologists, and to orthopaedic and plastic surgeons. *Ernest Muir*

LAPAGE, Geoffrey. [M.D., M.Sc., M.A., M.I.Biol.] **Parasitic Animals.** 2nd Edition, revised. pp. xxiii + 355, numerous illustrations. 1958. Cambridge: W. Heffer & Sons Ltd., 3 & 4, Petty Cury. [25s.]

The first edition of Dr. Lapage's book was well received by reviewers who expressed the opinion that, by reason of its wide range and interesting presentation of the subject, it was well suited to the needs not only of medical and veterinary practitioners, but also of all persons who were interested in natural science and who wished to read a good introductory book on parasitology.

Dr. Lapage's original work was designed to deal in very general terms with the role of parasites in nature, rather than to emphasize the medical, veterinary and economic importance of individual species. Such general principles remain fairly constant and, perhaps, it is for this reason that the present edition shows very little alteration from its predecessor, now 7 years old.

The only noteworthy addition is a list of some 32 publications dealing with parasitology. Books and papers suitable for readers with no previous training in the subject are marked with an asterisk, but it would have been helpful if an indication had been given of the size and cost of each of these publications, since some of them are large and expensive volumes, while others are short papers which have appeared in scientific journals.

So far as the reviewer can discover there are only a few slight alterations in the text and none in the illustrations. The few minor errors of fact, referred to in a previous review [this *Bulletin,* 1952, v. 49, 456], have not been fully corrected.

This eminently readable book is excellent value for 25/– and, in these days of ever increasing prices, it is a relief to find that the second edition with its improved quality of paper and binding costs only 4 shillings more than its parent. *R. M. Gordon*

NOTICES

Langley Memorial Prize—1959

The Langley Memorial Prize was founded by the friends of the late Dr. W. H. Langley, C.M.G., Principal Medical Officer, Southern Nigeria, to commemorate his work and the services he rendered both to Nigeria and to those who came under his care and skill.

The Prize, value approximately £21, is open to competition among officers, past and present, of the West African Medical Departments; it is awarded periodically for the best paper on one of the following subjects:—

(a) Tropical Medicine or Surgery
(b) Tropical Hygiene and Sanitation
(c) Tropical Entomology and Parasitology.

Special consideration is given to original work.

Joint applications are not accepted.

No officer who has already been awarded the Prize is eligible to re-enter.

The Prize will be awarded next in 1959. Entries, which may consist of either published or unpublished work, must be sent to the *Dean, London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1.* not later than 1st October 1959.

Ross Institute of Tropical Hygiene

Lay Course in Tropical Hygiene

To be held from 6th to 10th July 1959

The annual course for laymen will be held by the Ross Institute this year from Monday, 6th July to Friday, 10th July inclusive.

The course is designed specially for planters, mining engineers and other non-medical people who may be responsible for the health of industrial labour forces in the tropics. Admission is not restricted to such people, however, but is open to any non-medical men and women proceeding to the tropics.

The course consists of some formal teaching which is liberally illustrated by films, visits and demonstrations. The subjects covered include malaria and its control, other tropical diseases, nutrition, housing, sanitation, and protection against heat. The teaching is given by leading experts in each subject.

There is no fee for the course. Recognising its value, many companies pay the expenses of their staff during their stay in London, and the Ross Institute Standing Committee hopes that this practice will become general.

It would be appreciated if agencies and firms would inform their managers and assistants that this course is being organised and would encourage and assist them to attend. The names of those proposing to attend should be sent

as soon as possible to the Organising Secretary, but amendments and additions may be made at any time up to the date of commencement of the course.

It would be helpful if intending students would state their occupation and the country or district to which they are going. This will enable the organisers to arrange the programme according to requirements.

Further information on the detailed arrangements will be sent to those who have enrolled about a month prior to the date of the course.

Further copies of this notice will be sent on request to:— L. G. Ponsford, *Organising Secretary,* Ross Institute of Tropical Hygiene, London School of Hygiene and Tropical Medicine, Keppel Street (Gower Street), London, W.C.1. *Telephone:*—MUSeum 3041–4. LANgham 7621–5.

International Congress on Chagas's Disease

Rio de Janeiro, Brazil, 5–11 July, 1959

to commemorate the 50th anniversary of the discovery of the disease by Carlos Chagas. Details, including provisional programme, obtainable from Secretária do Congresso sôbre Doenças de Chagas, Academia Nacional de Medicina, Av. General Justo, 365—Rio de Janeiro.

It is with deep regret that we record the death on 7th February 1959 of Major General Sir John Taylor, *C.I.E.*, *D.S.O.*, M.D., D.P.H., I.M.S. (retd.), who made a number of valuable contributions to the *Tropical Diseases Bulletin* in the years after the Second World War.

The charge for Classified Advertisements is 7s. 6d. per line or part thereof.

Advertisements should be sent to the Bureau's agents, Messrs. Radclyffe's, Market House, The Parade, Taunton, Somerset.

All classified advertisements are accepted on the express terms (a) *that they are subject to cancellation at the discretion of the Editor* (*in the event of cancellation any money paid will be returned*), (b) *that the Editor may make any alteration in an advertisement to ensure its conformity with the standards of the Bureau of Hygiene and Tropical Diseases.*

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